User Manual

Allen-Bradley

Single Stage Compressor Control

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Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation® sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
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This manual provides a product and application overview, installation instructions, hardware description, Human Machine Interface (HMI) operation instructions, configuration instructions, controller operation instructions, Modbus configuration instructions, and troubleshooting information for the Single Stage Compressor Controller.

Who Should Use this Manual

This manual is intended for qualified personnel responsible for installing and operating the Rockwell Automation Single Stage Compressor Controller (SSCC). You should have previous experience with, and an understanding of, electrical terminology, procedures, required troubleshooting equipment, equipment protection procedures and methods, and safety precautions. See safety related practices contained in publication NFPA 70E, Standard for Electrical Safety in the Work Place.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
CompactLogix™ Controllers Specifications Technical Data, publication 1769-TD005.	Provides controller specifications.
CompactLogix Packaged Controllers Quick Start and User Manual, publication IASIMP-QS010.	Procedures for using your CompactLogix packaged controller as well as additional reference information.
Logix5000 Controllers Common Procedures, publication 1756-PM001.	Provides information on developing projects for Logix5000 controllers.
PanelView™ Plus Compact Terminals User Manual, publication 2711PC-UM001.	Provides instructions for installing, configuring, and operating PanelView Plus Compact terminals.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http:/www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

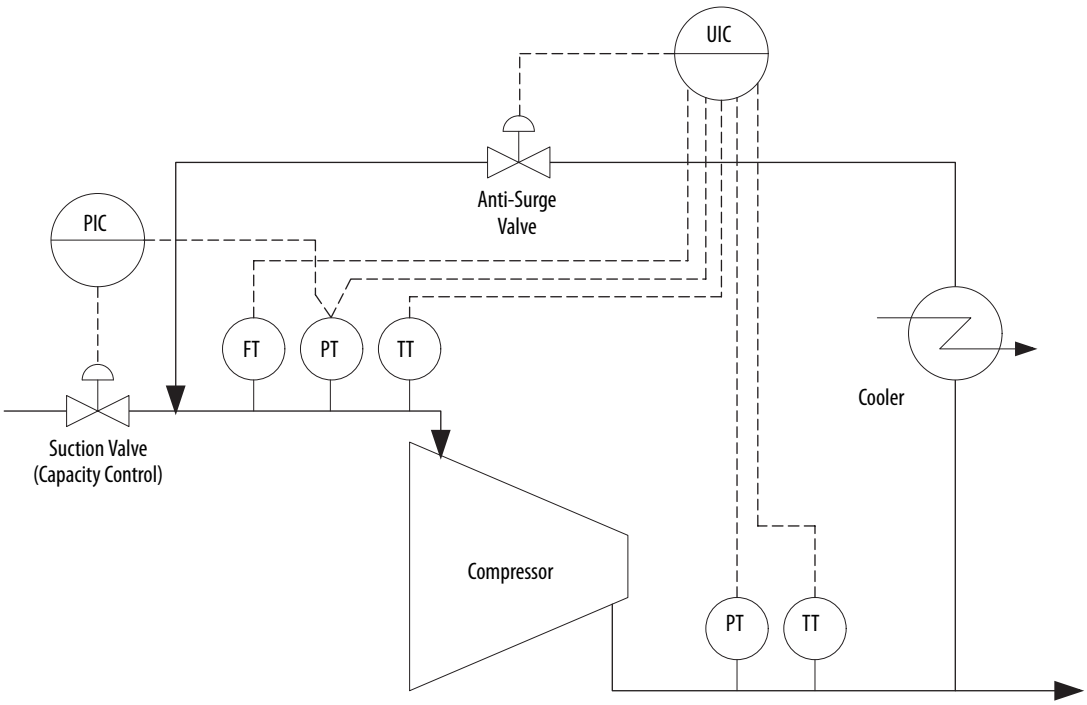
Notes:

Introduction

Product Description

The Single Stage Compressor Controller (SSCC) from Rockwell Automation is a packaged solution providing anti-surge and capacity control for a single-stage centrifugal or axial gas compressor. The SSCC is an economical compressor controller providing advanced control algorithms allowing for safe and energy efficient operation across the compressors operating range.

Figure 1 - Typical Compressor Controls

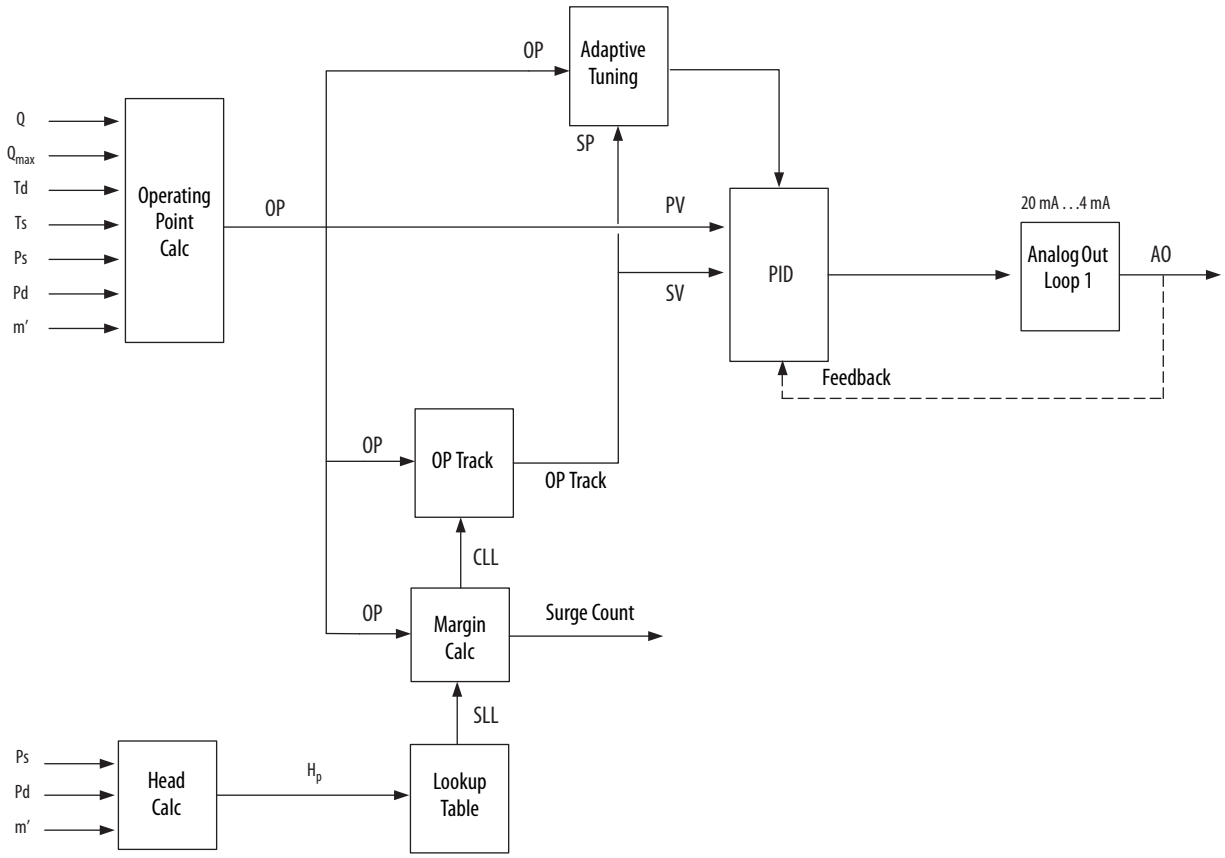


Application Overview

The SSCC utilizes a surge control algorithm which calculates a percent flow and determines the compressor's head (simplified polytropic or pressure ratio). If the percent flow is not adequate for the compressor's head, the recycle valve will be opened. The algorithm is used to generate a setpoint for the specialized PID loop. The surge control algorithm executes in less than 25 ms.

The following simplified functional block diagram illustrates the features of the algorithm. Secondary PID loop over-rides, and capacity control are not shown for clarity.

Figure 2 - Anti-surge Control Function Block Diagram



Functional aspects of the SSCC control strategy are summarized in the following table.

Table 1 - Application Function Summary

Function	Features
Analog Input Processing	Channel usage configuration (not-used, used, and usage type) Engineering unit calculation of process value (PV), with linear or square-root extraction Absolute value correction factor, for PVabs (Press & Temp signals) Under-range and over-range alarms Configurable PV high and low alarms Substitute PV mode to replace field signal with a substitute value Channel health monitoring and reporting Device faceplate on HMI
Digital Input Processing	Channel usage configuration (not-used, used) Input state (polarity of signal) Channel health monitoring and reporting Device faceplate on HMI
Digital Output Processing	Output state (polarity of signal) Operator mode for field device testing Channel health monitoring and reporting Device faceplate on HMI

Function	Features
Analog Output Processing	Device action (air-to-open, air-to-close) Position monitoring option Operator mode for field device testing Channel health monitoring and reporting Device faceplate on HMI
Compressor Head	Calculates the "head" of the compressor as simplified polytropic head (HpSim), pressure ratio (Pratio), and pressure rise (Prise) Choice of HpSim or Pratio as head type for the surge map Configuration error and calculation fault reporting
Operating Point	Calculates the operating point (OP) as a normalized, compensated representation of flow, compensated to base conditions of the surge map Supports four varieties of flow instrumentation for the compressor • Flow in suction • Flow in discharge, no cooling (inter-stage or upstream of flow) • Flow in discharge, downstream of inter-stage or discharge coolers • Alternate signal used in place of flow - special cases Configuration error and calculation fault reporting
Surge Map	10-segment surge map defines the surge limit line (SLL) Minimum flow fallback strategy on head calculation fault Option for inlet guide vane (IGV) adjustment methods Minimum IGV fallback on IGV position fault Dynamic compressor map on human machine interface (HMI)
Surge Detection	Compressor surge detection using: • Positional surge detection: OP falls below SLL • Rate-of-change surge: OP drops rapidly beyond configured limits • Incipient surge: Optional SurgeGard signal detection of impending surge
Control Margin	Calculation of the control limit line (CLL) using configurable margin Margin based on offset and percentage methods Convenient increment and decrement margin features Automatic margin increment on surge detection Minimum (base) and maximum margin limits
Operating Point Tracking	Calculates the surge control line (SCL) using OP tracking methods As OP increases above CLL, SCL tracks OP by a track margin When OP decreases back towards CLL, SCL decays at a track rate Configurable max limit, and minimum limited by CLL
Adaptive Tuning	Dynamic adjustment to PID loop tuning parameters (ASC primary PID loop) using configurable breakpoints and slopes When operating between breakpoints, tuning value is at base value When operating beyond breakpoints, tuning value automatically adjusted based on slopes
PID Controls	PID controller features: • Range configured automatically based on PV selection • Configurable setpoint management (track in manual, limits, rates) • PID control direction (direct, reverse) • Variety of tuning options • Manual mode override protection for anti-surge PID • PID faceplate on HMI
Min/Max Selector and Control/Track Management	When both the primary PID and a secondary (override) PID are configured, the configured min or max control signal is selected Non-selected PID loop tracks the selected PID loop by margin Control/track mode reporting
Control Slew Rate and Override Limits	Control value (CV) features: • Minimum and maximum limits • Opening and closing slew rate limits • Override/tripped/not running value
Anti-Surge and Capacity Decoupling	Decoupling between anti-surge and capacity controls Prevents capacity controls from driving compressor into surge

Function	Features
Surge Test and Capture	Built-in surge test methods Used to validate surge map Traps operating data on surge detection Surge point presented on compressor map
Interlock Management	Four configurable external interlocks for compressor trip Management of external and internal interlocks with first-out indication Configurable interlock bypass features Compressor trip output for interface to drive controller
Permissive Management	Four configurable external permissives for compressor ready-to-start Management of external and internal permissives with first-out indication Configurable permissive bypass features Ready-to-start output for interface to drive controller

Single Stage Compressor Controller Installation

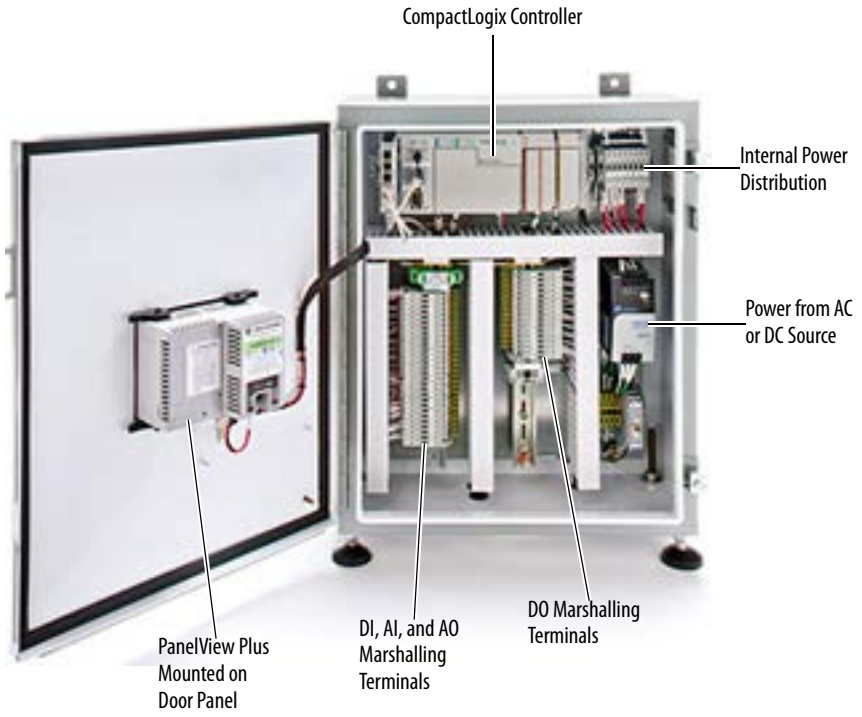
Single Stage Compressor Controller Components

The Single State Compressor Controller (SSCC) is composed of the following components:

- Enclosure
- CompactLogix controller
- Digital inputs
- Digital outputs
- Analog inputs
- Analog outputs
- PanelView Plus HMI

All the SSCC required components are mounted, wired and installed inside the unit's enclosure, from the factory. This section describes the steps for installation.

Figure 3 - SSCC Panel - Interior View


CompactLogix Controller
Internal Power Distribution
Power from AC or DC Source
PanelView Plus Mounted on Door Panel
DI, AI, and AO Marshalling Terminals
DO Marshalling Terminals

Mechanical Installation

Electrostatic Precautions

The electronic components of these systems are susceptible to electrostatic discharge. Be sure to take the following precautions.

- Always wear an anti-static wrist strap (or equivalent) when handling any electrostatic sensitive components.
- All electrostatic sensitive components will be packaged in anti-static bags. Do not remove these components from these bags until you are ready to install them.
- Controller modules are especially sensitive to electrostatic discharge; pay special attention not to touch the module connectors or any exposed printed circuit board (PCB) components.
- Store all shipping materials, especially anti-static bags, to re-use if it becomes necessary to transport or ship any system components.

Unpack

All items must be removed from their packaging and checked against the packing list. Verify that all items are correct and contact Rockwell Automation if any discrepancies are found. Before unpacking any items, the packaging must be inspected for damage which may have occurred during shipment. See the "Inspection" section.

If any packaging is damaged, the package identifying marks (box number, crate number, etc.) must be noted and communicated to Rockwell Automation. The package must be stored in a suitable storage area in the condition it was received. Rockwell Automation will contact the shipping agent who may request to inspect the damage. The package must not be opened without the express written permission of Rockwell Automation.

Inspection

- Visually inspect the cabinets for mechanical damage, check the painted surfaces for scratches and abrasions.
- Check that the cabinet door opens and closes, and that all latches operate smoothly.
- Check all internal components against the detailed layout drawings, and be sure that these components were not damaged during shipment.
- Check cable assemblies to make sure they were not damaged during shipment. All wire ducts should be fitted with covers and all cable assemblies should be appropriately dressed with cable ties and/or spiral wrap.

Environmental/Location Requirements

To meet environmental requirements when installing the equipment, it should be installed in a room with an ambient temperature of -10...+50 °C (14...122 °F) with a relative humidity of 0% to 95% relative humidity, non-condensing; and the room must be provided with adequate lighting.

Tools

An adjustable wrench and socket set are required for panel installation.

Mount the Enclosure

1. Determine the mounting location and be sure it is able to support 31.8 kg (70 lb). Allow sufficient room above and below, or at the left and right sides, for cable exiting the enclosure, and for opening the door.
2. Mark the wall through the top of the slots in *only* the top two mounting key holes. Drill the necessary holes for the bolts.
3. Insert the bolts through the bottom two mounting key holes of the enclosure and into the wall. DO NOT tighten the bolts at this time.
4. Mark the wall through the holes in the top two mounting holes. Remove the enclosure from the wall, drill the necessary holes for the bolts, and re-hang the enclosure onto the bottom two bolts.
5. Insert bolts through the holes in the top two mounting holes of the enclosure and into the wall. Tighten all the bolts.

Power Distribution and Grounding

System can be powered by 24V DC or 120V AC. Connect power to terminals shown in the supplied wiring drawings. Terminal locations are identified in this photograph.

Alternate DC Sourced Power Connection (Regulated 24V DC)
AC Sourced Power Connection (100…240V AC)
Instrument Ground Connection
AC Safety Ground Connection

There are two different ground connections that must be connected before power is applied to the system. The AC safety ground is for all exposed metal surfaces of cabinets, racks, chassis ground connections, etc. (All individual ground wiring interconnections are to be a minimum of 16 AWG, copper wire, green insulation). Instrument ground is for all DC analog/digital, signal cable shield wires. Reference ground wiring interconnections will be a minimum of 18 AWG, copper wire, green insulation, with yellow tracer.

ATTENTION: Good ground connections must be verified before any work can be carried out by any Rockwell Automation or client personnel. Failure to comply may cause serious injury.

Check for a good electrical AC safety ground connection. The electrical ground connection must be matched to the breakers or fuses used to protect the feeds to the system. Check the integrity of the connection and the gauge of the wire used, that it is sufficient to allow the breakers or fuses to trip.

Single Stage Compressor Controller Powerup

First time power up must be done in stages to guard against system-wide power distribution faults. The system's power distribution must be verified against the power distribution drawings.

1. Switch all circuit breakers to the Off position and open all fuses.
2. Energize the 24V DC or 120V AC feed, and verify voltage at the main incoming terminals.
3. Close each 120V AC circuit breaker, one at a time, and verify that the corresponding power supply is energized.
4. Measure the output voltage of the power supply and verify it is delivering 24V DC.
5. Close each 24V DC fuse, one at a time, and verify the corresponding equipment receives 24V DC by measuring at the power terminals of the receiving equipment.
6. Close all 24V DC fuses, checking that the system powers-up as expected.

Notes:

SSCC Hardware Description

Controller

The SSCC hardware and software platform is the 1769-L23E-QB1B CompactLogix system. The controller comes preconfigured with sixteen digital inputs and sixteen digital outputs. For the SSCC system, two expansion 1769-Series I/O modules are added for analog inputs (1769-IF8) and analog outputs (1769-OF4).

Figure 4 - CompactLogix Controller L23E

Digital Inputs

The SSCC has 16 digital inputs powered by 24V DC. All inputs are prewired from marshalling terminal blocks (TS1) to the module specific removable terminal blocks.

Table 2 - Digital Input Channel Assignment and Wiring

Input	Description	TS1
Channel 0	Compressor Running contact	1-2
Channel 1	Reset push button	3-4
Channel 2	Load Compressor request push button	5-6
Channel 3	Unload Compressor request push button	7-8
Channel 4	Reserved for future use	9-10
Channel 5	Reserved for future use	11-12
Channel 6	Reserved for future use	13-14
Channel 7	Reserved for future use	15-16
Channel 8	External Ready-to-start Permissive 1	17-18
Channel 9	External Ready-to-start Permissive 2	19-20
Channel 10	External Ready-to-start Permissive 3	21-22
Channel 11	External Ready-to-start Permissive 4	23-24
Channel 12	External Trip Interlock 1	25-26
Channel 13	External Trip Interlock 2	27-28
Channel 14	External Trip Interlock 3	29-30
Channel 15	External Trip Interlock 4	31-32

Notes:

- Accessories (push buttons) for use on channels 1, 2, and 3 are not provided with the unit; the customer must purchase and install accessories separately, as required. For each of these signals, the equivalent functionality is provided on the graphic screens of the unit's HMI.
- Digital input signal function polarity is configurable for each channel.
- Each channel is configurable for "use" or "not-used." Signals present on channels configured as "not-used" are ignored.

Digital Outputs

The SSCC has 16 digital outputs powered by 24VDC. All outputs are prewired from marshalling terminal blocks (TS2) to the module specific removable terminal blocks.

Table 3 - Digital Output Channel Assignment and Wiring

Output	Description	TS2
Channel 0	Compressor Trip/Interlock	1-2
Channel 1	Surge Alarm	3-4
Channel 2	System Trouble Alarm	5-6
Channel 3	Ready-to-start Permissive	7-8
Channel 4	Compressor Running Status Indication	9-10
Channel 5	Compressor Loaded Status Indication	11-12
Channel 6	Reserved for future use	13-14
Channel 7	Reserved for future use	15-16
Channel 8	Reserved for future use	17-18
Channel 9	Reserved for future use	19-20
Channel 10	Reserved for future use	21-22
Channel 11	Reserved for future use	23-24
Channel 12	Reserved for future use	25-26
Channel 13	Reserved for future use	27-28
Channel 14	Reserved for future use	29-30
Channel 15	Reserved for future use	31-32

Notes:

- All digital output channels are 24V DC sourcing outputs.
- Digital output signal function polarity is configurable per channel.
- Compressor trip/interlock (channel 0) is intended for connection to the compressor driver (motor, turbine, etc.) to shutdown the compressor.
- Read-to-start permissive (channel 1) is intended for connection to the compressor driver (motor, turbine, etc.) as a permissive to start the compressor.

Analog Inputs

The SSCC has eight analog inputs (current 4...20 mA). All inputs are prewired from marshalling terminal blocks (TS1) to the module specific removable terminal blocks.

Table 4 - Analog Input Channel Assignment and Wiring

Input	Description	TS1	Configuration Options
Channel 0	Compressor Flow	33-34	Flow Transmitter located: Compressor Suction, or Compressor Discharge, or Alternate Signal when no Flow signal (consult factory for advice)
Channel 1	Suction Pressure	35-36	Pressure Transmitter in Compressor Suction
Channel 2	Discharge Pressure	37-38	Pressure Transmitter in Compressor Discharge
Channel 3	Auxiliary Control Signal	39-40	Auxiliary Process Transmitter. An optional signal that may be used for capacity control, or anti-surge override control
Channel 4	Suction Temperature	41-42	Temperature Transmitter in Compressor Suction
Channel 5	Discharge Temperature	43-44	Temperature Transmitter in Compressor Discharge
Channel 6	Multi-Use Signal A	45-46	Choose connection to: Anti-Surge Valve position Transmitter, or Capacity Valve / Inlet Guide Vane position Transmitter, or Incipient Surge (SurgeGard) signal
Channel 7	Multi-Use Signal B	47-48	Choose connection to: Anti-Surge Valve position Transmitter, or Capacity Valve / Inlet Guide Vane position Transmitter, or Incipient Surge (SurgeGard) signal

Notes:

- Each channel has configurable engineering unit scaling, linearization type, and alarm limits.
- Flow, suction pressure and discharge pressure (channels 0, 1, and 2) represent the minimum required signals for anti-surge control.
- Temperatures (channels 4 and 5) are often optional, but are required when flow is measured in discharge and the compressor has inter-stage cooling or discharge cooling upstream of flow measurement.
- SurgeGard for incipient surge detection is sold separately. Space is allocated in the panel for mounting and wiring to the system.

Analog Outputs

The SSCC has four analog outputs (current 4...20 mA). All outputs are prewired from marshalling terminal blocks (TS1) to the module specific removable terminal blocks.

Table 5 - Analog Output Channel Assignment and Wiring

Input	Description	TS1	Device
Channel 0	Anti-Surge Control Valve	49-50	Typically Recycle Valve or Blow-Off Valve.
Channel 1	Capacity Control Device	51-52	Typically Suction Valve, Inlet Guide Vanes, Discharge Valve, or Cascade setpoint to Speed Controller.
Channel 2	Reserved for future	53-54	None
Channel 3	Reserved for future	55-56	None

Note: For each analog output, the application control signal 0...100% open can be configured to actuate the device as air-to-open or air-to-close.

PanelView Plus Compact Graphic Terminal

The SSCC is equipped with a PanelView Plus Compact color graphic terminal for a HMI. This device is used as the interface for operation and configuration of the SSCC. The HMI is installed on the door of the unit control panel and wiring for power and communication are provided from factory. The standard HMI is the PanelView Plus Compact 600 with 5.5 in. color touchscreen. The PanelView Plus Compact 1000 with 10.4 in. color touchscreen can be ordered as an option for the SSCC.

Figure 5 - PanelView Plus Compact 600 Graphic Terminal

Figure 6 - PanelView Plus Compact 1000 Graphic Terminal

Human Machine Interface

The human machine interface (HMI) provides a single interface for configuration, operation, maintenance and troubleshooting the SCCC system. This chapter familiarizes you with these general features and how to access them. Further details are found later in this manual.

Activate the HMI

The operator interface requires entry of an Activation Key ID to activate the HMI for use. Until the HMI has been successfully activated the HMI will only display the following screen.

Figure 7 - HMI Activation Screen

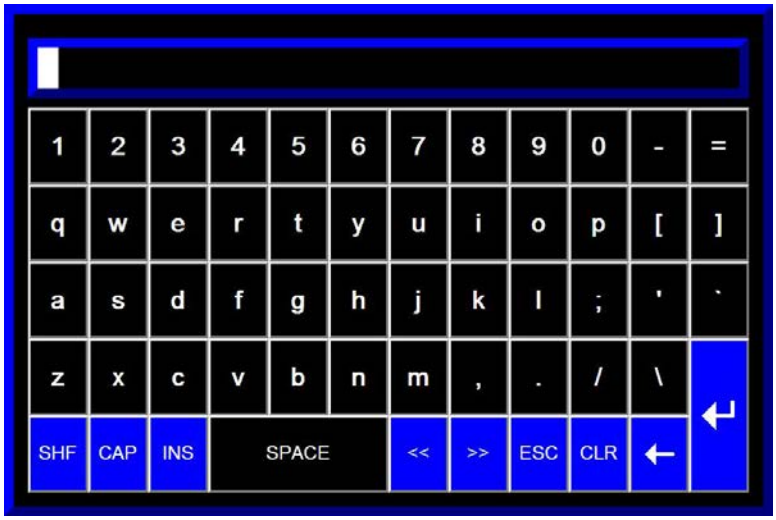
Rockwell Automation
Product Not Activated
System Serial Number:
C01D917C
Product ID Number:
P02
Provide your Serial Number and Product ID to your Authorized Rockwell Automation agent to receive your Activation Key ID
Enter Activation Key ID:

Each SSCC requires a unique, eight-character HMI activation Key ID. The Key ID can be provided from an Authorized Rockwell Automation agent. You will need to provide them the System Serial Number and Product ID Number as shown on your Activation screen.

Follow these steps to activate the HMI.

1. On the Activation screen, press the Enter Activation Key ID entry line.

   The following keypad appears.

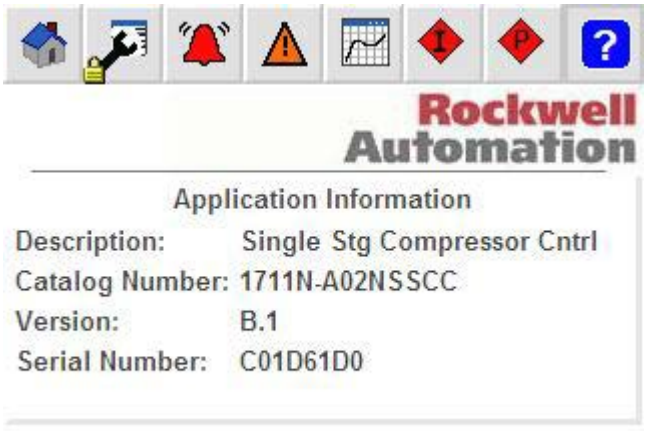


2. Enter the Key ID using the touch keypad.

   Note: The characters in the Key ID are NOT case sensitive. Only enter the eight character ID. Do not enter any dashes, spaces, or other symbols. For example, if your agent provides the Key ID of 23F4-60BC, only enter the eight characters, 23F460BC (or 23f460bc), omitting the dash symbol.

   If the Key ID you entered is not valid, the Activation screen remains on the HMI. In this case, verify the Key ID entered and correct if necessary. If activation problems continue, contact Rockwell Automation for further assistance.

   If the Key ID is valid and the HMI activation is successful, the toolbar is displayed at the top of the screen and the Application Information screen appears.



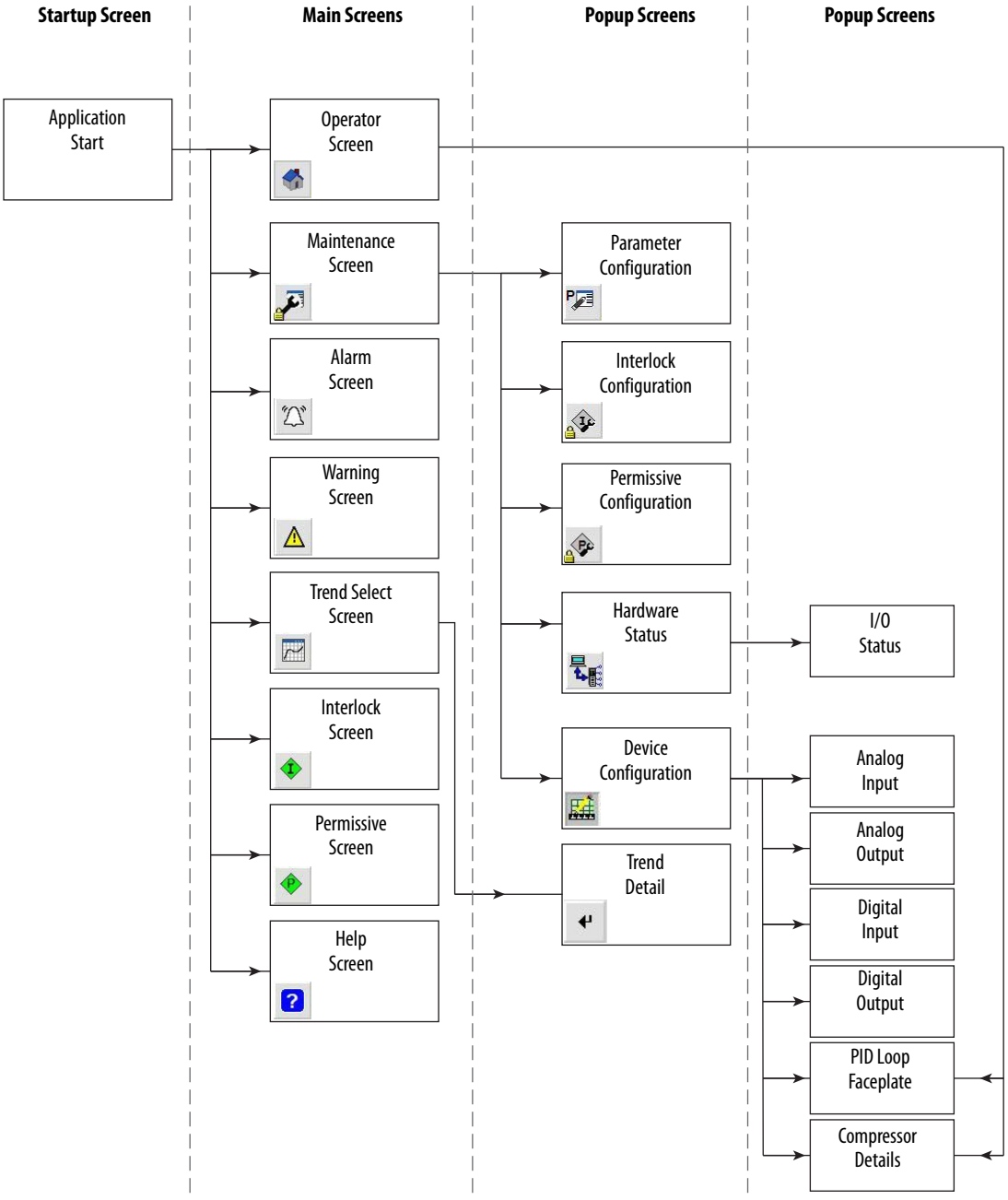
Navigation

The HMI application facilitates user navigation through a centralized icon toolbar. The toolbar icons access the following eight main screens.

- Operator
- Maintenance
- Alarms
- Warnings
- Trends
- Interlocks
- Permissives
- Help

Each of the main screens accesses additional screens that allow you to fully configure the SSCC. A navigational hierarchy is presented in Figure 8 on page 28.

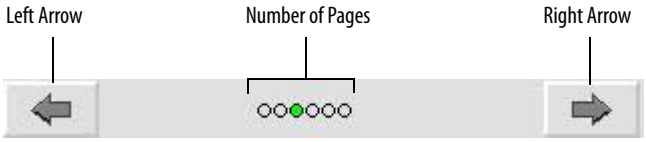
Figure 8 - HMI Screens Navigational Hierarchy



Navigation Toolbar

Each main screen contains at least one page, where pages are equivalent to displays. In order to access a main screen, press the corresponding button on the upper navigation toolbar.

When a main screen contains multiple pages, a page navigation bar is presented at the bottom of the screen, as shown here. When the screen has only one page, the page navigation bar is not presented.



The number of pages is represented by the number of dots presented in the center of the navigation bar. The green dot indicates which page is presently shown on the screen.

Use the right arrow button to navigate forward and the left arrow button to navigate backwards through the pages of the screen. Navigation forward from the last screen returns to the first screen and vice versa.

Operator Screen Overview

From any main screen, press the home icon on the navigation toolbar to open the Operator screen. The Operator screen contains six pages for operations. When the Operator screen appears, the last viewed page is presented.

Table 6 - Operator Screen Pages

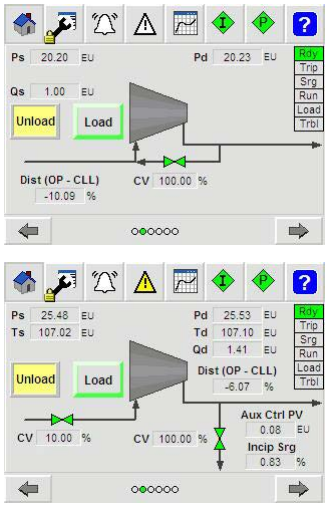
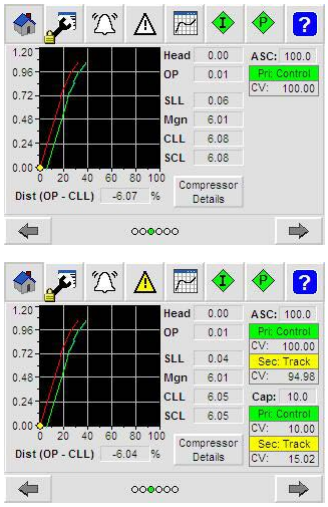
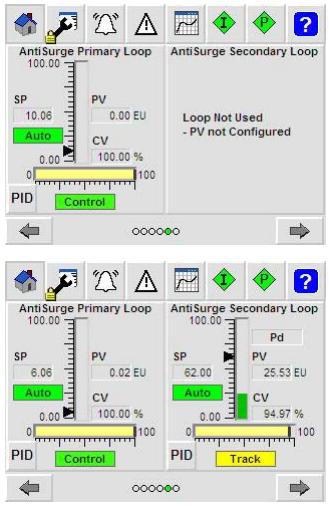
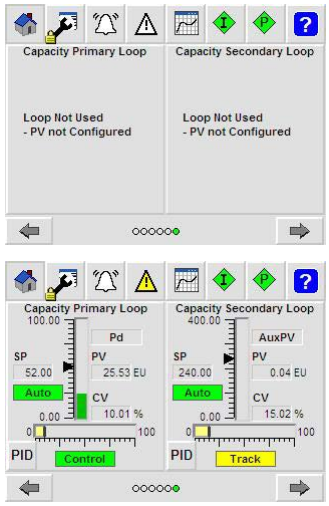
Page	Example Screen(s)	Description
1		Operator Screen – User Login Display Features: • Date and time of the HMI Operational Features: • Press to log in and obtain user security privileges • Press to log off (return to Default user, with no security privileges)
2		Operator Screen – Compressor Overview Display Features: • Signal values for all configured transmitters (AINs) • Anti-surge valve control value and location • Capacity control value and device type/location (if configured) • Overall unit status indicators (ready, trip, surge, run, load, trouble) Operational Features: • Press Load to load the compressor – security privilege required (O, S, M, or E) • Press Unload to unload the compressor – security privilege required (O, S, M, or E)
3		Operator Screen – Compressor Map Display Features: • Compressor map for Surge Limit Line (SLL), Control Limit Line (CLL) and Surge Control Line (SCL) with live Operating Point (OP) • Anti-surge calculated values for Head, OP, SLL, Margin, CLL, SCL and Distance of OP from Control Limit Line • Summary of anti-surge and capacity PID loop outputs and control values (for configured loops) Operational Features: • Press the Compressor Details to open the Compressor Details popup screen for additional anti-surge information and settings

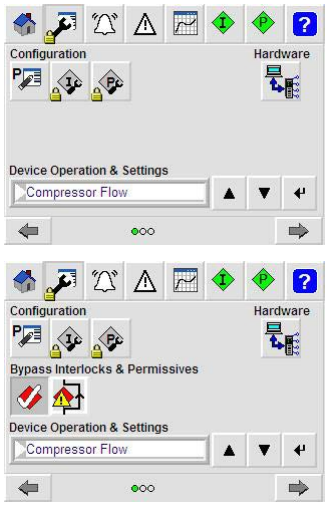
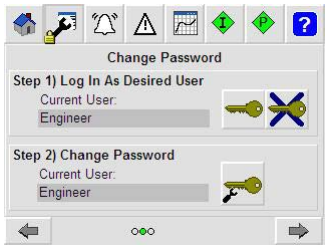
Table 6 - Operator Screen Pages (Continued)

Page	Example Screen(s)	Description
4		Operator Screen – Margin Control Display Features: • Anti-surge margin information Operational Features: • Press ▲ (margin increment) and ▼ (margin decrement) to adjust margin – security privilege required (O, S, M, or E) • Modify Base, Max Margin, and Margin Adjustment - security privilege required (M, E, or A)
5		Operator Screen – Anti-Surge Control PID Loops Overview Display Features: • Overview of Anti-surge control PID loops (PV, SP, Output, Mode) • Anti-surge secondary (Override) PID loop is only shown when configured. Operational Features: • Press PID to open individual PID loop faceplates for detailed PID loop operation and tuning
6		Operator Screen – Capacity Control PID Loops Overview Display Features: • Overview of Capacity Control PID Loops (PV, SP, Output, Mode) • Capacity PID loops are only shown when configured Operational Features: • Press PID to open individual PID loop faceplates for detailed PID loop operation and tuning

Maintenance Screen Overview

From any main screen, press the Maintenance icon on the navigation toolbar to open the Maintenance screen. The Maintenance screen has three pages for configuration and maintenance activities. When the Maintenance screen opens, the last viewed page is presented.

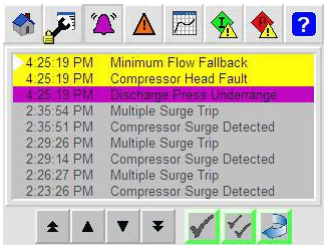
Table 7 - Maintenance Screen Pages

Page	Example Screen(s)	Description
1		Maintenance Screen – Configuration and Settings Display Features: • Access to configuration, device settings, and hardware status monitoring • Bypass interlocks and permissives only shown if configured Operational Features: • Press to access Parameter Configuration popup screen • Press to access Interlocks Configuration popup screen • Press to access Permissives Configuration popup screen • Press to access Hardware popup screen to access controller and PanelView Plus status information • Press to disable bypass for interlocks and permissives – security privilege required (M, E, or A) • Press to enable bypass for the configured Interlocks and permissives – security privilege required (M, E, or A) • Use to choose a device and press to open a Device Detail popup (for AIN, DIN, AOUT, DOUT, PID Loop, and Compressor Details)
2		Maintenance Screen – Change Password Display Features: • Access to login/logout and change passwords Operational Features: • Press to log in with user security privileges • Press to log off (return to default user, with no security privileges) • Press to change the password for the current user – security privilege required (O, S, M, E, or A as applicable)
3		Maintenance Screen – Localization Display Features: • Language selection • Units of measure selection Operational Features: • Press the flag that represents the language choice for the HMI • Press for either Primary or Secondary units – security privilege required (E or A). This selection switches the text for Units between the user configured primary and secondary units text strings.

Alarms Screen Overview

From any main screen, press the Alarm icon on the navigation toolbar to open the Alarm screen. The Alarm screen has only one page, containing an alarm list for the unit alarms.

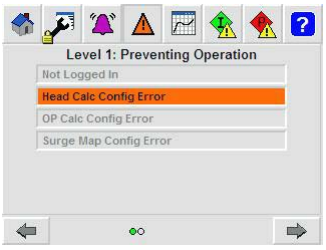
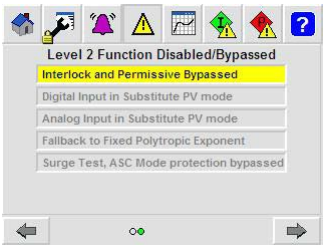
Table 8 - Alarm Screen Pages

Page	Example Screen	Description
1		Alarm Screen Display Features: • List of alarms - current and historical • Alarm colors represent severity levels • Flashing indicates “Unacknowledged,” Steady indicates “Acknowledged” • Scrollable list maintains history of last 128 alarms Operational Features: • Use ▲ and ▼ to choose an individual alarm for acknowledgement. • Use ⏫ and ⏬ to scroll through the list one page at a time • Press ✓ to acknowledge the selected alarm – security privilege required (O, S, M, E, or A) • Press ✓✓ to acknowledge all the un-acknowledged alarms in the list – security privilege required (O, S, M, E, or A) • When available, press to send an alarm reset to the application to reset the Summary Alarm icon indication – security privilege required (O, S, M, E, or A)

Warnings Screen Overview

From any main screen, press the Warnings icon on the navigation toolbar to open the Warnings screen. The Warnings screen has two pages for alerting the user regarding important errors or other operating condition. When the Warnings screen opens, the last viewed page is presented to the user.

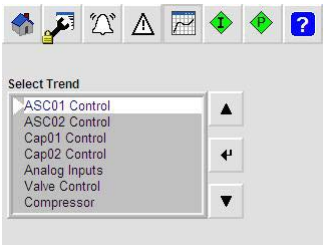
Table 9 - Warnings Screen Pages

Page	Example Screen	Description
1		Warnings Screen – Level 1: Preventing Operation Display Features: • Level 1 warnings are presented by an orange color • The Warning icon on the top navigation toolbar will change color to alert the operator when a warning condition is present Operational Features: • No user operations required from this screen
2		Warnings Screen – Level 2: Function Disabled/Bypassed Display Features: • Level 2 warnings are presented by an yellow color • The Warning icon on the top navigation toolbar will change color to alert the operator when a warning condition is present Operational Features: • No user operations required from this screen

Trend Select Screen Overview

From any main screen, press the Trend icon on the navigation toolbar to open the Trend Select screen. The Trend Select screen has only one page, containing a list of trend groups.

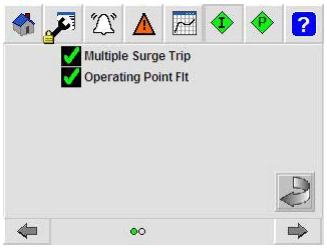
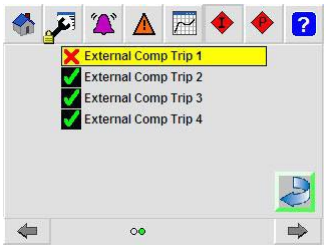
Table 10 - Trend Select Screen Pages

Page	Example Screen	Description
1		Trend Select Screen Display Features: • Trend Group selector Operational Features: • Use ▲ and ▼ to choose the desired trend group. • Press ↵ to open the Trend Detail popup screen for the chosen trend group

Interlocks Screen Overview

From any main screen, press the Interlock icon on the navigation toolbar to open the Interlocks screen. The Interlocks screen has two pages, presenting the condition of the compressor interlocks.

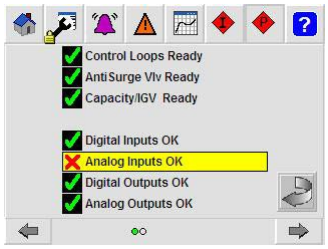
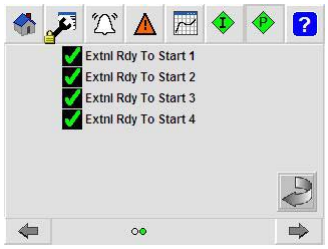
Table 11 - Interlocks Screen Pages

Page	Example Screen	Description
1		Interlocks Screen – Internal Interlocks Display Features: • Internal Interlocks organized on page one • First-Out interlock displayed in yellow color Operational Features: • When available, press to reset latched interlocks that have cleared – security privilege required (O, S, M, E, or A)
2		Interlocks Screen – External Interlocks Display Features: • External interlocks organized on page two • First-Out interlock displayed in yellow color Operational Features: • When available, press to reset latched interlocks that have cleared – security privilege required (O, S, M, E, or A)

Permissives Screen Overview

From any main screen, press the Permissive icon on the navigation toolbar to open the Permissives screen. The Permissives screen has 2 pages, presenting the condition of the compressor permissives.

Table 12 - Permissives Screen Pages

Page	Example Screen	Description
1		Permissives Screen – Internal Logic Permissives Display Features: • Internal permissives organized on page one • First-out permissive displayed in yellow color Operational Features: • Permissives are non-latching so use of Reset button is not required (O, S, M, E, or A)
2		Permissives Screen – External Permissives Display Features: • External permissives organized on page two • First-Out permissive displayed in yellow color Operational Features: • Permissives are non-latching so use of Reset button is not required (O, S, M, E, or A)

Help Screen Overview

From any main screen, press the Help icon on the navigation toolbar to open the Help screen. The Help screen has eight pages, presenting HMI operational help organized under a variety of topics.

Table 13 - Help Screen Pages

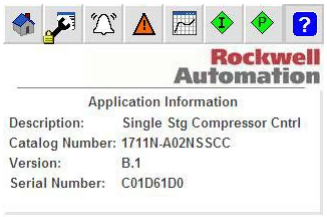
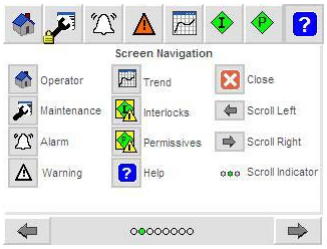
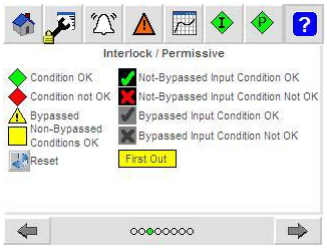
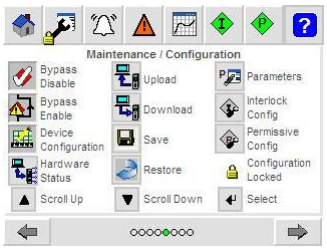
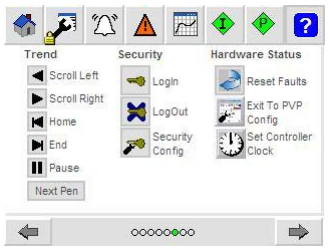
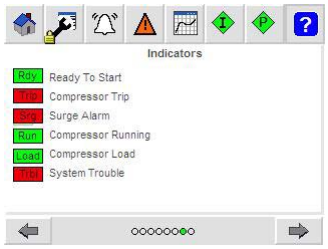
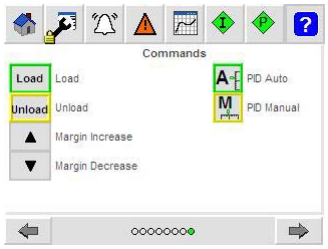
Page	Example Screen	Description
1		Help Screen – Product Identification Display Features: • Product Description, Catalog Number, Version and Serial Number Operational Features: • No operational actions required from this page
2		Help Screen – Navigation Display Features: • Navigation icon toolbar items identified • Page navigation and page scrolling identified Operational Features: • No operational actions required from this page
3		Help Screen – Interlocks/Permissives Display Features: • Interlock and permissive icon symbols identified • Interlock and permissive signal status indications identified Operational Features: • No operational actions required from this page
4		Help Screen – Alarms/Warnings Display Features: • Alarm icon severity/classification colors identified • Alarm screen operation buttons identified • Warning icon classification colors identified Operational Features: • No operational actions required from this page
5		Help Screen – Maintenance/Configuration Display Features: • Configuration buttons identified • Bypass Enable/Disable buttons identified • Parameter list configuration and management identified Operational Features: • No operational actions required from this page

Table 13 - Help Screen Pages (Continued)

Page	Example Screen	Description
6		Help Screen – Trends/Security/Hardware Status Display Features: • Trend popup screen operational buttons identified • Security access buttons identified • Hardware status management buttons identified Operational Features: • No operational actions required from this page
7		Help Screen – Indicators Display Features: • Compressor operation summary indicators identified Operational Features: • No operational actions required from this page
8		Help Screen – Commands Display Features: • Operating buttons identified Operational Features: • No operational actions required from this page

HMI Security

The HMI includes a security model to restrict access to specific functions. The model relies on user roles which are defined in the following table.

Table 14 - HMI User Roles and Passwords

User Name	Initial Password	Security Privilege Abbr.
Operator	operator	O
Supervisor	supervisor	S
Maintenance	maintenance	M
Engineer	engineer	E
Administrator	password	A

Notes:

- User names ARE NOT case sensitive. For example, “operator”, “Operator”, and “OPERATOR” are all valid for the Operator user name.
- Passwords ARE case sensitive. For example, the default password for the Operator user is “operator”, all lower-case.
- User names cannot be changed.

- Passwords can be changed. Follow the instructions later in this section to change the password for a user role.
- The security model includes a default user, which has no security privileges. When the HMI is powered up, or when logged out, the security access returns to the default level.
- Security privilege abbreviations (O, S, M, E, A) are used in other parts of this manual to indicate the user role required to perform an action on the HMI.

User Login

User login is available from either the Operator or Maintenance screen within the HMI. Follow the appropriate steps to access the desired screen.

Log in from the Operator Screen

1. Press to close any open pop-up screens and return to a main screen showing the navigation toolbar.
2. Press on the navigation toolbar.

   The Operator screen appears.
3. Press to page forward, or to page backward, as required to navigate to page one of the Operator screen.
4. Continue with Log In on page 40.

Log in from the Maintenance Screen

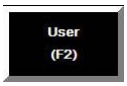
1. Press to close any open pop-up screens and return to a main screen showing the navigation toolbar.
2. Press on the navigation toolbar.

   The Maintenance screen appears.
3. Press to page forward, or to page backward, as required to navigate to page two of the Maintenance screen.
4. Continue with Log In on page 40.

Log In

1. Click .

   The Login dialog box appears.

2. Press  .

   The on-screen keypad appears.

3. Enter the User name. Note: User names are not case sensitive.

4. Press .

   The Login dialog box re-appears.

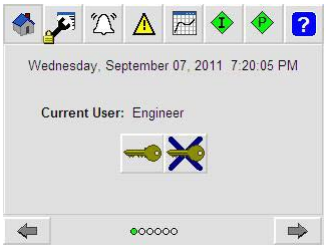
5. Press .

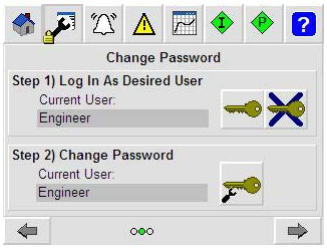
   The on-screen keypad appears.

6. Enter the Password. Note: Passwords are case sensitive.

7. Press .

   The Login dialog box closes and the Main screen appears. If login was successful, the current user name shown on the main screen will reflect the new login. Note: If the current user does not reflect the new Login, repeat steps 1...7 of this procedure.





User Logout

When logged in, the HMI provides you with particular security privileges based on your user role. In order to safeguard against unauthorized changes to configuration or operational modes, it is recommended that you logout and return to the default user role, which has no security privileges, when the unit is unattended.

You can logout from either the Operator or Maintenance screen. Follow these steps to log out of the HMI.

1. Complete the steps in User Login on page 39 to access either the Operator or Maintenance screen.
2. Press to return to the default user access level.

Change the User Password

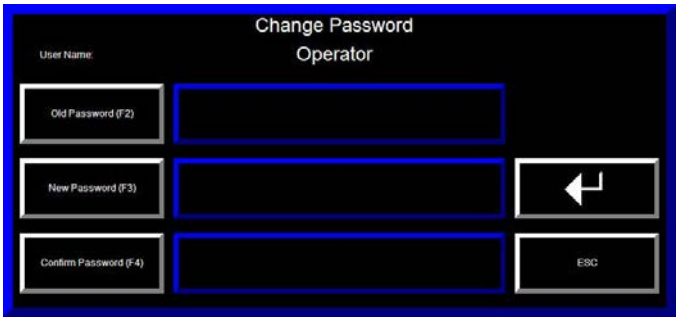
The HMI application has initial passwords set for each user role as presented earlier in this chapter. From the HMI, it is possible to change the password for each user role. Changing the user password requires the following two main processes.

- Login as the desired user
- Change the password for the user.

Follow these steps to change the user password.

1. Complete the steps in User Login on page 39 to access the Maintenance screen - Login/Change Password page.
2. Press .

   The Change Password dialog box appears.



3. Press

.

The on-screen keypad appears.

4. Enter the Old Password. Note: Passwords are case sensitive.
5. Press .

   The Change Password dialog box re-appears.

6. Press

.

   The on-screen keypad appears.

7. Enter the New Password. Note: Passwords are case sensitive.
8. Press .

   The Change Password dialog box re-appears.

9. Press

.

   The on-screen keypad appears.

10. Enter the New Password again to confirm. Note: Passwords are case sensitive.
11. Press .

    The Change Password dialog box re-appears.

12. Press .

If you successfully changed the password, the Main screen appears. An error message is displayed to indicate when the password change was not successful. Follow the guidance presented in the error message and repeat the procedure.

HMI Functions with Security Privileges

The following tables list the functions on the HMI screens that require security privileges, and the corresponding user roles that can perform the function.

User Roles are: O = Operator
S = Supervisor
M = Maintenance
E = Engineer
A = Administrator

Table 15 - Operator Screen

Page	Function Requiring Security Privilege	User Roles
Page 2 – Compressor Overview	Load button	O, S, M or E
	Unload button	O, S, M or E
Page 4 – Margin Control	Margin Increment button	O, S, M or E
	Margin Decrement button	O, S, M or E
	Base Offset Margin value	M, E, or A
	Base Percent Margin value	M, E, or A
	Maximum Margin value	M, E, or A
	Margin Adjust Amount value	M, E or A
	Margin Adjust Type value	M, E, or A

Table 16 - Maintenance Screen

Page	Function Requiring Security Privilege	User Roles
Page 1 – Configuration and Settings	Bypass Enable button	M, E, or A
	Bypass Disable button	M, E, or A
Page 3 – Localization	Unit of Measure select	E or A

Table 17 - Alarm Screen

Page	Function Requiring Security Privilege	User Roles
Page 1 - Alarms	Alarm Acknowledge button	O, S, M, E or A
	Alarm Acknowledge All button	O, S, M, E or A
	Alarm Reset button	O, S, M, E or A

Table 18 - Interlocks Screen

Page	Function Requiring Security Privilege	User Roles
Page 1 – Internal Interlocks, and Page 2 – External Interlocks	Interlock Reset button	O, S, M, E or A

Table 19 - Permissives Screen

Page	Function Requiring Security Privilege	User Roles
Page 1 – Internal Permissives, and Page 2 – External Permissives	Permissive Reset button	Not used, permissives do not latch

Table 20 - Interlocks Configuration Screen (popup)

Page	Function Requiring Security Privilege	User Roles
Page 1 – Internal Interlocks, and Page 2 – External Interlocks	Interlock Bypassable select	E or A
	Interlock Description string	E or A

Table 21 - Permissives Configuration Screen (popup)

Page	Function Requiring Security Privilege	User Roles
Page 1 – Internal Permissives, and Page 2 – External Permissives	Permissive Bypassable select	E or A
	Permissive Description string	E or A

Table 22 - Parameter Configuration Screen (popup)

Page	Function Requiring Security Privilege	User Roles
Page 1 - Parameter Configuration	Restore button	O, S, M, E or A
	Upload button	E or A
	Download button	E or A
	Edit Parameter button	E or A
	Save button	E or A

Table 23 - Hardware Status Screen (popup)

Page	Function Requiring Security Privilege	User Roles
Page 2 – Controller Fault Status Details	Fault Reset button	O, S, M, E or A
Page 3 – PanelView Plus Information	Set Clock button	E or A
	Exit to PanelView Config button	E or A

Table 24 - Digital Input Device Screen (popup)

Page	Function Requiring Security Privilege	User Roles
Page 1 – Operator	Use Input PV button	M, E or A
	Use Substitute PV button	M, E or A
	Substitute PV state buttons	M, E or A
Page 2 – Configuration	Disallow Substitute PV setting	E or A
	Use this Signal setting	E or A
	Device Description string	E or A

Table 25 - Digital Output Device Screen (popup)

Page	Function Requiring Security Privilege	User Roles
Page 1 – Operator	Operator Mode button	O, S, M or E
	Program Mode button	O, S, M or E
	Output Command buttons	O, S, M or E
Page 2 – Configuration	Fail On setting	E or A
	Device Description string	E or A

Table 26 - Analog Input Device Screen (popup)

Page	Function Requiring Security Privilege	User Roles
Page 1 – Operator	Use Input PV button	M, E or A
	Use Substitute PV button	M, E, or A
	Substitute PV value	M, E or A
Page 2 – Configuration	PV EU Minimum value	E or A
	PV EU Maximum value	E or A
	Has Extended Scaling setting	E or A
	Square-root Extract setting	E or A
	Has Hi Alarm setting	E or A
	Has Lo Alarm setting	E or A
	Hi Alarm Limit value	E or A
	Lo Alarm Limit value	E or A
	Alarm Deadband value	E or A
	Primary Units of Measure string	E or A
	Secondary Units of Measure string	E or A
	Device Description string	E or A

Table 27 - Analog Output Device Screen (popup)

Page	Function Requiring Security Privilege	User Roles
Page 1 – Operator	Operator Mode button	O, S, M or E
	Program Mode button	O, S, M or E
	Operator Control value	O, S, M or E

Table 27 - Analog Output Device Screen (popup)

Page	Function Requiring Security Privilege	User Roles
Page 2 – Configuration	CV EU Minimum value	Value set by logic
	CV EU Maximum value	Value set by logic
	Fail Open setting	Value set by logic
	Has Low Resolution AO setting	Value set by logic
	Has Position Feedback setting	Value set by logic
	Deviation DB value	Value set by logic
	Deviation Minimum Duration value	Value set by logic
	Primary Unit of Measure string	E or A
	Secondary Unit of Measure string	E or A
	Device Description string	E or A

Table 28 - PID Loop Device Screen (popup)

Page	Function Requiring Security Privilege	User Roles
Page 1 – Operator	Auto Mode button	O, S, M or E
	Manual Mode button	O, S, M or E
	Setpoint value	O, S, M or E
	Manual CV value	O, S, M or E
Page 2 – Configuration (All Loops)	Device Description string	E or A
	Primary PV Unit of Measure string	E or A
	Secondary PV Unit of Measure string	E or A
	Primary CV Unit of Measure string	E or A
	Secondary CV Unit of Measure string	E or A

Table 28 - PID Loop Device Screen (popup) (Continued)

Page	Function Requiring Security Privilege	User Roles
Page 2 – Configuration (ASC Primary Loop with Adaptive Tuning)	Proportional Break Point 1 value	E or A
	Proportional Break Point 2 value	E or A
	Proportional Slope 1 value	E or A
	Proportional Slope 2	E or A
	Proportional Maximum Limit value	E or A
	Proportional Minimum Limit value	E or A
	Integral Break Point 1 value	E or A
	Integral Break Point 2 value	E or A
	Integral Slope 1 value	E or A
	Integral Slope 2 value	E or A
	Integral Maximum Limit value	E or A
	Integral Minimum Limit value	E or A
	Proportional Base value	M, E or A
	Integral Base value	M, E or A
Page 2 – Configuration (Other Loops with Conventional Tuning)	Setpoint Minimum Limit value	M, E or A
	Setpoint Maximum Limit value	M, E or A
	Setpoint Increase Rate value	M, E or A
	Setpoint Decrease Rate value	M, E or A
	SetPoint Track PV in Manual setting	E or A
	Proportional Tuning value	M, E or A
	Integral Tuning value	M, E or A
	Derivative Tuning value	M, E or A
	Interactive Tuning setting	E or A

Table 29 - Compressor Details Screen (popup)

Page	Function Requiring Security Privilege	User Roles
Tab 1 – Compressor Head	Ratio of Specific Heats value	E or A
	Polytropic Efficiency value	E or A
	Polytropic Exponent Type setting	E or A
	Max Polytropic Exponent Limit value	E or A
	Min Polytropic Exponent Limit value	E or A

Table 29 - Compressor Details Screen (popup) (Continued)

Page	Function Requiring Security Privilege	User Roles
Tab 2 - Base Conditions	Orifice Base Pressure value	E or A
	Orifice Base Temperature value	E or A
	Orifice Maximum Flow value	E or A
	Compressor Base Pressure value	E or A
	Compressor Base Temperature value	E or A
	Gas Molecular Weight value	E or A
	Gas Compressibility	E or A
	Use IGV Position for Map setting	E or A
	IGV Minimum Position Limit value	E or A
Tab 3 – Surge Map	Surge Map – X-axis OP values	E or A
	Surge Map – Y-Axis Head values	E or A
	Surge Map – IGV Position values	E or A
Tab 4 – OPTrack/Decoupling	OP Track – Max Track Limit value	M, E or A
	OP Track – Track Margin value	M, E or A
	OP Track – Track Rate value	M, E or A
	Decoupling – Initiate Point 1 value	M, E or A
	Decoupling – Release Point 2 value	M, E or A
	Use Decoupling setting	E or A
Tab 5 – ASC and CAP valves	ASCV – Open Slew Rate value	M, E or A
	ASCV – Close Slew Rate value	M, E or A
	ASCV – Max CV Limit value	M, E or A
	ASCV – Min CV Limit value	M, E or A
	ASCV – CV NotRun/Unload/Trip value	M, E or A
	ASCV – Position Deviation DB value	M, E or A
	ASCV – Position Deviation Time value	M, E or A
	CapCV – Open Slew Rate value	M, E or A
	CapCV – Close Slew Rate value	M, E or A
	CapCV – Max CV Limit value	M, E or A
	CapCV – Min CV Limit value	M, E or A
	CapCV – CV NotRun/Unload/Trip value	M, E or A
	CapCV – Position Deviation DB value	M, E or A
	CapCV – Position Deviation Time value	M, E or A
Tab 6 – Surge Configuration	Multi-Surge Trip Quantity value	E or A
	Multi-Surge Trip Time value	E or A
	Rate-of-Change Low value	M, E or A
	Rate-of-Change Deadband value	M, E or A
	Rate-of-Change Time value	M, E or A
	Positional Surge Margin value	M, E or A
	Reset Surge Count button	E or A

Table 29 - Compressor Details Screen (popup) (Continued)

Page	Function Requiring Security Privilege	User Roles
Tab 7 – Surge Test	Activate Surge Test button	E or A
	DeActivate Surge Test button	E or A
	Use Pos. Surge for Test setting	E or A
	Use RoC Surge for Test setting	E or A
	Use Incip Surge for Test setting	E or A
	Reset Trapped Data button	E or A

Notes:

SSCC Configuration

This section contains the steps required to configure the SSCC. The SSCC can be applied to a variety of control requirements including anti-surge control, capacity/performance control, additional protection/override controls, as well as unit interlocks and permissives.

Parameter Lists

Because of the wide range of control capabilities, there is a large amount of configuration choices which can be made in order to meet the requirements of the application. Configuration choices have been organized into groups called "parameter lists." Thus, the configurable parameters grouped together in a parameter list represent a device (for example, a transmitter), or a control function (for example, a PID loop) or a common theme (for example, the compressor surge map).

Each parameter list contains the parameter number, description, range, and initial value. A User-configured Value column is also provided in each table for recording purposes. To use this feature, print the lists and record any values changed during configuration in this column.

Table 30 identifies the parameter lists and provides a summary of the configuration parameters that make up the list.

Table 30 - Available Configuration Parameter Lists

Parameter List Name	Summary of Parameters
01: AIN - Compressor Flow on page 53	Usage, engineering unit scaling, and alarm configuration.
02: AIN - Suction Pressure on page 54	Usage, engineering unit scaling, and alarm configuration.
03: AIN - Discharge Pressure on page 55	Usage, engineering unit scaling, and alarm configuration.
04: AIN - Auxiliary Control Signal on page 56	Usage, engineering unit scaling, and alarm configuration.
05: AIN - Suction Temperature on page 57	Usage, engineering unit scaling, and alarm configuration.
06: AIN - Discharge Temperature on page 58	Usage, engineering unit scaling, and alarm configuration.
07: AIN - Multi-use Signal A on page 59	Usage, engineering unit scaling, and alarm configuration.
08: AIN - Multi-use Signal B on page 60	Usage, engineering unit scaling, and alarm configuration.
09: Digital Input Channel Configuration on page 61	DI channel usage and signal state configuration.
10: Digital Output Channel Configuration on page 63	DO channel control state configuration.
11: Compressor Configuration Information on page 63	Base properties for the compressor map, flow measurement, gas properties, head calculation method, inlet guide vane usage.

Table 30 - Available Configuration Parameter Lists (Continued)

Parameter List Name	Summary of Parameters
12: Surge Map Definition on page 65	Compressor surge map (10-segment lookup table) values (head vs. operating point, plus inlet guide vane positions if applicable).
13: Surge and Margin Configuration on page 66	Anti-surge control margin properties, surge detection properties, and operating point tracking properties.
14: Run and Load Configuration on page 68	Compressor run determination, and manual/auto load configuration.
15: Anti-Surge Control General Configuration on page 69	Anti-surge control and valve properties including control value limits, slew rates, position deviation alarming. Anti-surge PID loop min/max selection and tracking.
16: ASC Primary PID Loop on page 70	Configuration properties for the primary anti-surge PID loop. This loop is always configured to control the anti-surge valve.
17: ASC Primary PID Loop - Adaptive Integral on page 72	Adaptive integral tuning parameters for the primary anti-surge PID loop.
18: ASC Primary PID Loop - Adaptive Proportional on page 73	Adaptive proportional tuning parameters for the primary anti-surge PID loop.
19: ASC Secondary PID Loop on page 74	Configuration properties for the secondary anti-surge PID loop. This is the optional protection/override PID loop which may be used to control the anti-surge valve.
20: Capacity Control General Configuration on page 76	Capacity control and valve/device properties including control value limits, slew rates, position deviation alarming. Capacity PID loop min/max selection and tracking.
21: Capacity Primary PID Loop on page 78	Configuration properties for the primary capacity PID loop. When capacity control is required, this is the PID loop used to control the capacity valve/device.
22: Capacity Secondary PID Loop on page 80	Configuration properties for the secondary capacity PID loop. This is the optional protection/override PID loop which may be used to control the capacity valve/device.
23: Anti-Surge - Capacity Decoupling Configuration on page 82	Configures the use of decoupling between the anti-surge and capacity controls.
24: AINs - Substitute PV on page 83	Configure each analog input channel to allow/disallow the use of substitute PV.
25: DINs - Substitute PV on page 84	Configure each digital input channel to allow/disallow the use of substitute PV.
26: Reserved for Future Use on page 84	Intentionally omitted from the HMI, reserved for future use only.
27: Interlock Bypassable Configuration on page 85	Configure the bypass option for individual interlocks.
28: Permissive Bypassable Configuration on page 86	Configure the bypass option for individual permissives.
29: Modbus Serial Port Configuration on page 87	Configure, set and read the configuration for the Modbus serial port of the controller.
30: Application (HMI Configuration) on page 88	HMI application configuration properties (consult factory before making any changes). Configure whether bypasses are permitted for the unit.

Refer to the following sections for details on each of the parameter lists, and the configuration settings and options for the parameters that make up each list.

01: AIN - Compressor Flow

List 01 defines the usage, engineering unit scaling and linearization, and alarm configuration for the analog input channel 0 for compressor flow. The compressor flow input is the primary input used to calculate the operating point (OP) value of the compressor.

The following table identifies the configuration parameters, range limits, and initial values.

Table 31 - Parameter List 01: AIN – Compressor Flow

No.	Description	Range	Initial Value	User-configured Value
01	Channel Usage Configuration. Choices: 1 = Qs, suction flow 2 = Qd, discharge flow, and no inter-stage or discharge coolers 3 = Qdd, discharge flow downstream of any inter-stage or discharge coolers (requires suction and discharge temperatures to be configured) 4 = Qalt, an alternate measurement signal is used instead of Flow (special case, requires special considerations to determine surge map)	1…4	1	
02	Engineering Unit Scale Max Limit (EU). The scaled engineering unit value at 20 mA input.	-999999…999999	100	
03	Engineering Unit Scale Min Limit (EU). The scaled engineering unit value at 4 mA input.	-999999…999999	0	
04	Scaling Type. Choices: 0 = Linear 1 = Square-root extraction (applicable to flow signals)	0 or 1	1	
05	Extrapolate Scaling, if input beyond normal limits. 0 = No, clamp EU value at min and max limits 1 = Yes, extrapolate EU value beyond limits	0 or 1	0	
06	Absolute Adjustment, Engineering Units (applicable to pressure and temperature signals).	0…999999	0	
07	Has Alarm High Level. 0 = No, high level alarm not to be used 1 = Yes, high level alarm to be used	0 or 1	0	
08	Has Alarm Low Level. 0 = No, low level alarm not to be used 1 = Yes, low level alarm to be used	0 or 1	0	
09	High Alarm Limit Value. Engineering Units.	-999999…999999	100	
10	Low Alarm Limit Value. Engineering Units.	-999999…999999	0	
11	Alarm Deadband. Engineering units.	0…999999	0	

02: AIN - Suction Pressure

List 02 defines the usage, engineering unit scaling and linearization, and alarm configuration for the analog input channel 1 for suction pressure. The suction pressure input is used for the following purposes.

- A variable in calculating the compressor "head"
- As pressure compensation in the operating point calculation (when flow usage is Qs, Qd, or Qdd)
- As the process variable (PV) for the anti-surge secondary (override) PID loop, or capacity primary or capacity secondary PID loops (if selected)

The following table identifies the configuration parameters, range limits, and initial values.

Table 32 - Parameter List 02: AIN – Suction Pressure

No.	Description	Range	Initial Value	User-configured Value
01	Channel Usage Configuration. Choices: 0 = Not configured 1 = Suction Pressure Usage should always be configured = 1. In rare cases where the compressor has no suction pressure transmitter, configure = 1 and use substitute PV to set the value equal to the compressor base pressure.	0 or 1	1	
02	Engineering Unit Scale Max Limit (EU). The scaled engineering unit value at 20 mA input.	-999999…999999	100	
03	Engineering Unit Scale Min Limit (EU). The scaled engineering unit value at 4 mA input.	-999999…999999	0	
04	Scaling Type. Choices: 0 = Linear 1 = Square-root extraction (applicable to flow signals)	0 or 1	0	
05	Extrapolate Scaling, if input beyond normal limits. 0 = No, clamp EU value at min and max limits 1 = Yes, extrapolate EU value beyond limits	0 or 1	0	
06	Absolute Adjustment. Engineering units. If transmitter is a gauge transmitter, enter the amount to convert to absolute pressure. If the transmitter is an absolute transmitter, enter 0.	0…999999	0	
07	Has Alarm High Level. 0 = No, high level alarm not to be used 1 = Yes, high level alarm to be used	0 or 1	0	
08	Has Alarm Low Level. 0 = No, low level alarm not to be used 1 = Yes, low level alarm to be used	0 or 1	0	
09	High Alarm Limit Value. Engineering units.	-999999…999999	100	
10	Low Alarm Limit Value. Engineering units.	-999999…999999	0	
11	Alarm Deadband. Engineering units.	0…999999	0	

03: AIN - Discharge Pressure

List 03 defines the usage, engineering unit scaling and linearization, and alarm configuration for the analog input channel 2 for discharge pressure. The discharge pressure input is used for the following purposes.

- A variable in calculating the compressor "head"
- As pressure compensation in the operating point calculation (when flow usage is Qd or Qdd)
- As the process variable (PV) for the anti-surge secondary (override) PID loop, or capacity primary or capacity secondary PID loops (if selected)

The following table identifies the configuration parameters, range limits, and initial values.

Table 33 - Parameter List 03: AIN – Discharge Pressure

No.	Description	Range	Initial Value	User-configured Value
01	Channel Usage Configuration. Choices: 0 = Not configured 1 = Discharge Pressure Usage should always be configured = 1.	0 or 1	1	
02	Engineering Unit Scale Max Limit (EU). The scaled engineering unit value at 20 mA input.	-999999…999999	100	
03	Engineering Unit Scale Min Limit (EU). The scaled engineering unit value at 4 mA input.	-999999…999999	0	
04	Scaling Type. Choices: 0 = Linear 1 = Square-root extraction (applicable to flow signals)	0 or 1	0	
05	Extrapolate Scaling, if input beyond normal limits. 0 = No, clamp EU value at min and max limits 1 = Yes, extrapolate EU value beyond limits	0 or 1	0	
06	Absolute Adjustment. Engineering units. If transmitter is a gauge transmitter, enter the amount to convert to absolute pressure. If the transmitter is an absolute transmitter, enter 0.	0…999999	0	
07	Has Alarm High Level. 0 = No, high level alarm not to be used 1 = Yes, high level alarm to be used	0 or 1	0	
08	Has Alarm Low Level. 0 = No, low level alarm not to be used 1 = Yes, low level alarm to be used	0 or 1	0	
09	High Alarm Limit Value. Engineering units.	-999999…999999	100	
10	Low Alarm Limit Value. Engineering units.	-999999…999999	0	
11	Alarm Deadband. Engineering units.	0…999999	0	

04: AIN - Auxiliary Control Signal

List 04 defines the usage, engineering unit scaling and linearization, and alarm configuration for the analog input channel 3 provided for an auxiliary control signal. The auxiliary input signal is used for the following purposes.

- As the process variable (PV) for the anti-surge secondary (override) PID loop, or capacity primary or capacity secondary PID loops (if selected)

The following table identifies the configuration parameters, range limits, and initial values.

Table 34 - Parameter List 04: AIN – Auxiliary Control Signal

No.	Description	Range	Initial Value	User-configured Value
01	Channel Usage Configuration. Choices: 0 = Not configured 1 = Configured for use The auxiliary control signal is optional.	0 or 1	0	
02	Engineering Unit Scale Max Limit (EU). The scaled engineering unit value at 20 mA input.	-999999…999999	100	
03	Engineering Unit Scale Min Limit (EU). The scaled engineering unit value at 4 mA input.	-999999…999999	0	
04	Scaling Type. Choices: 0 = Linear 1 = Square-root extraction (applicable to flow signals)	0 or 1	0	
05	Extrapolate Scaling, if input beyond normal limits. 0 = No, clamp EU value at min and max limits 1 = Yes, extrapolate EU value beyond limits	0 or 1	0	
06	Absolute Adjustment. Engineering units. If transmitter is a gauge transmitter, enter the amount to convert to absolute value. If the transmitter is an absolute transmitter, enter 0.	0…999999	0	
07	Has Alarm High Level. 0 = No, high level alarm not to be used 1 = Yes, high level alarm to be used	0 or 1	0	
08	Has Alarm Low Level. 0 = No, low level alarm not to be used 1 = Yes, low level alarm to be used	0 or 1	0	
09	High Alarm Limit Value. Engineering units.	-999999…999999	100	
10	Low Alarm Limit Value. Engineering units.	-999999…999999	0	
11	Alarm Deadband. Engineering units.	0…999999	0	

05: AIN - Suction Temperature

List 05 defines the usage, engineering unit scaling and linearization, and alarm configuration for the analog input channel 4 for suction temperature. The suction temperature input is used for the following purposes.

- A variable in calculating the compressor "head" (when variable polytropic exponent is configured)
- As temperature compensation in the operating point calculation (when flow usage is Qdd)

The following table identifies the configuration parameters, range limits, and initial values.

Table 35 - Parameter List 05: AIN - Suction Temperature

No.	Description	Range	Initial Value	User-configured Value
01	Channel Usage Configuration. Choices: 0 = Not configured 1 = Suction temperature configured for use The suction temperature configuration is required when the flow usage is configured as Qdd.	0 or 1	0	
02	Engineering Unit Scale Max Limit (EU). The scaled engineering unit value at 20 mA input.	-999999…999999	100	
03	Engineering Unit Scale Min Limit (EU). The scaled engineering unit value at 4 mA input.	-999999…999999	0	
04	Scaling Type. Choices: 0 = Linear 1 = Square-root extraction (applicable to flow signals)	0 or 1	0	
05	Extrapolate Scaling, if input beyond normal limits. 0 = No, clamp EU value at min and max limits 1 = Yes, extrapolate EU value beyond limits	0 or 1	0	
06	Absolute Adjustment. Engineering units. For internal calculations, the temperature must be converted into absolute units. Enter the absolute adjustment value: For DegF transmitters: set to 460 to convert to DegR For DegC transmitters: set to 273 to convert to DegK Suction and discharge transmitters must be in the same units.	0…999999	0	
07	Has Alarm High Level. 0 = No, high level alarm not to be used 1 = Yes, high level alarm to be used	0 or 1	0	
08	Has Alarm Low Level. 0 = No, low level alarm not to be used 1 = Yes, low level alarm to be used	0 or 1	0	
09	High Alarm Limit Value. Engineering units.	-999999…999999	100	
10	Low Alarm Limit Value. Engineering units.	-999999…999999	0	
11	Alarm Deadband. Engineering units.	0…999999	0	

06: AIN - Discharge Temperature

List 06 defines the usage, engineering unit scaling and linearization, and alarm configuration for the analog input channel 5 for discharge temperature. The discharge temperature input is used for the following purposes.

- A variable in calculating the compressor "head" (when variable polytropic exponent is configured)
- As temperature compensation in the operating point calculation (when flow usage is Qdd)

The following table identifies the configuration parameters, range limits, and initial values.

Table 36 - Parameter List 06: AIN – Discharge Temperature

No.	Description	Range	Initial Value	User-configured Value
01	Channel Usage Configuration. Choices: 0 = Not configured 1 = Discharge temperature configured for use The discharge temperature configuration is required when the flow usage is configured as Qdd.	0 or 1	0	
02	Engineering Unit Scale Max Limit (EU). The scaled engineering unit value at 20 mA input.	-999999…999999	100	
03	Engineering Unit Scale Min Limit (EU). The scaled engineering unit value at 4 mA input.	-999999…999999	0	
04	Scaling Type. Choices: 0 = Linear 1 = Square-root extraction (applicable to flow signals)	0 or 1	0	
05	Extrapolate Scaling, if input beyond normal limits. 0 = No, clamp EU value at min and max limits 1 = Yes, extrapolate EU value beyond limits	0 or 1	0	
06	Absolute Adjustment. Engineering units. For internal calculations, the temperature must be converted into absolute units. Enter the absolute adjustment value: For DegF transmitters: set to 460 to convert to DegR For DegC transmitters: set to 273 to convert to DegK Suction and discharge transmitters must be in the same units.	0…999999	0	
07	Has Alarm High Level. 0 = No, high level alarm not to be used 1 = Yes, high level alarm to be used	0 or 1	0	
08	Has Alarm Low Level. 0 = No, low level alarm not to be used 1 = Yes, low level alarm to be used	0 or 1	0	
09	High Alarm Limit Value. Engineering units.	-999999…999999	100	
10	Low Alarm Limit Value. Engineering units.	-999999…999999	0	
11	Alarm Deadband. Engineering units.	0…999999	0	

07: AIN - Multi-use Signal A

List 07 defines the usage, engineering unit scaling and linearization, and alarm configuration for the analog input channel 6 for multi-use signal A. The multi-use signal input can be used for the following purposes.

- A valve position feedback transmitter, for either the anti-surge valve, or the capacity control valve/guide vanes.
- The incipient surge detection signal from the optional SurgeGard device.

The following table identifies the configuration parameters, range limits, and initial values.

Note: Multi-use signal A and multi-use signal B usage should not be configured for the same signal type.

Table 37 - Parameter List 07: AIN – Multi-use Signal A

No.	Description	Range	Initial Value	User-configured Value
01	Channel Usage Configuration. Choices: 0 = Not configured 1 = PosA, anti-surge valve position transmitter 2 = PosCap, capacity valve/guide vane position transmitter 3 = SG, SurgeGard incipient surge detection signal. Note: When configured for SurgeGard incipient surge detection signal, the High Alarm is used as the signal threshold that triggers the incipient surge control value increment action (see parameter 09 in list 15: Anti-Surge Control General Configuration on page 69).	0…3	0	
02	Engineering Unit Scale Max Limit (EU). The scaled engineering unit value at 20 mA input.	-999999…999999	100	
03	Engineering Unit Scale Min Limit (EU). The scaled engineering unit value at 4 mA input.	-999999…999999	0	
04	Scaling Type. Choices: 0 = Linear 1 = Square-root extraction (applicable to flow signals)	0 or 1	0	
05	Extrapolate Scaling, if input beyond normal limits. 0 = No, clamp EU value at min and max limits 1 = Yes, extrapolate EU value beyond limits	0 or 1	0	
06	Absolute Adjustment. Engineering units. Not applicable for this signal, set to 0.	0…999999	0	
07	Has Alarm High Level. 0 = No, high level alarm not to be used 1 = Yes, high level alarm to be used	0 or 1	0	
08	Has Alarm Low Level. 0 = No, low level alarm not to be used 1 = Yes, low level alarm to be used	0 or 1	0	
09	High Alarm Limit Value. Engineering units.	-999999…999999	100	
10	Low Alarm Limit Value. Engineering units.	-999999…999999	0	
11	Alarm Deadband. Engineering units.	0…999999	0	

08: AIN - Multi-use Signal B

List 08 defines the usage, engineering unit scaling and linearization, and alarm configuration for the analog input channel 7 for multi-use signal A. The multi-use signal input can be used for the following purposes.

- A valve position feedback transmitter, for either the anti-surge valve, or the capacity control valve/guide vanes.
- The incipient surge detection signal from the optional SurgeGard device.

The following table identifies the configuration parameters, range limits, and initial values.

Note: Multi-use signal A and multi-use signal B usage should not be configured for the same signal type.

Table 38 - Parameter List 08: AIN – Multi-use Signal B

No.	Description	Range	Initial Value	User-configured Value
01	Channel Usage Configuration. Choices: 0 = Not configured 1 = PosA, anti-surge valve position transmitter 2 = PosCap, capacity valve/guide vane position transmitter 3 = SG, SurgeGard incipient surge detection signal Note: When configured for SurgeGard incipient surge detection signal, the High Alarm is used as the signal threshold that triggers the incipient surge control value increment action (see parameter 09 in list 15: Anti-Surge Control General Configuration on page 69).	0…3	0	
02	Engineering Unit Scale Max Limit (EU). The scaled engineering unit value at 20 mA input.	-999999…999999	100	
03	Engineering Unit Scale Min Limit (EU). The scaled engineering unit value at 4 mA input.	-999999…999999	0	
04	Scaling Type. Choices: 0 = Linear 1 = Square-root extraction (applicable to flow signals)	0 or 1	0	
05	Extrapolate Scaling, if input beyond normal limits. 0 = No, clamp EU value at min and max limits 1 = Yes, extrapolate EU value beyond limits	0 or 1	0	
06	Absolute Adjustment. Engineering units. Not applicable for this signal, set to 0.	0…999999	0	
07	Has Alarm High Level. 0 = No, high level alarm not to be used 1 = Yes, high level alarm to be used	0 or 1	0	
08	Has Alarm Low Level. 0 = No, low level alarm not to be used 1 = Yes, low level alarm to be used	0 or 1	0	
09	High Alarm Limit Value. Engineering units.	-999999…999999	100	
10	Low Alarm Limit Value. Engineering units.	-999999…999999	0	
11	Alarm Deadband. Engineering units.	0…999999	0	

09: Digital Input Channel Configuration

List 09 defines the usage and signal state for the all of the digital input channels. The following table identifies the configuration parameters, range limits, and initial values.

Table 39 - Parameter List 09: Digital Input Channel Configuration

No.	Description	Range	Initial Value	User-configured Value
01	Use Compressor Run Signal input (DI Channel 0). 0 = No, do not use this signal 1 = Yes, Use this signal for compressor run detection	0 or 1	0	
02	Compressor Run State (DI Channel 0). 0 = Compressor running state when input is Off 1 = Compressor running state when input is On	0 or 1	1	
03	Use Reset Push Button Signal Input (DI Channel 1). 0 = No, do not use this signal 1 = Yes, Use this signal for Reset push button	0 or 1	0	
04	Reset Push Button State (DI Channel 1). 0 = Trigger reset action when input is Off 1 = Trigger reset action when input is On	0 or 1	1	
05	Use Load Push Button Signal Input (DI Channel 2). 0 = No, do not use this signal 1 = Yes, use this signal for Load push button	0 or 1	0	
06	Load Push Button State (DI Channel 2). 0 = Trigger load request when input is Off 1 = Trigger load request when input is On	0 or 1	1	
07	Use Unload Push Button Signal Input (DI Channel 3). 0 = No, do not use this signal 1 = Yes, Use this signal for Unload push button	0 or 1	0	
08	Unload Push Button State (DI Channel 3). 0 = Trigger unload request when input is Off 1 = Trigger unload request when input is On	0 or 1	1	
09	Use External Ready-To-Start-1 Signal Input (DI Channel 8). 0 = No, do not use this signal 1 = Yes, use this signal for Ready-To-Start-1 condition	0 or 1	0	
10	External Ready-To-Start-1 State (DI Channel 8). 0 = Ready-To-Start state when input is Off 1 = Ready-To-Start state when input is On	0 or 1	1	
11	Use External Ready-To-Start-2 Signal Input (DI Channel 9). 0 = No, do not use this signal 1 = Yes, use this signal for Ready-To-Start-2 condition	0 or 1	0	
12	External Ready-To-Start-2 State (DI Channel 9). 0 = Ready-To-Start state when input is Off 1 = Ready-To-Start state when input is On	0 or 1	1	
13	Use External Ready-To-Start-3 Signal Input (DI Channel 10). 0 = No, do not use this signal 1 = Yes, use this signal for Ready-To-Start-3 condition	0 or 1	0	
14	External Ready-To-Start-3 State (DI Channel 10). 0 = Ready-To-Start state when input is Off 1 = Ready-To-Start state when input is On	0 or 1	1	

Table 39 - Parameter List 09: Digital Input Channel Configuration (Continued)

No.	Description	Range	Initial Value	User-configured Value
15	Use External Ready-To-Start-4 Signal Input (DI Channel 11). 0 = No, do not use this signal 1 = Yes, use this signal for Ready-To-Start-4 condition	0 or 1	0	
16	External Ready-To-Start-4 State (DI Channel 11). 0 = Ready-To-Start state when input is Off 1 = Ready-To-Start state when input is On	0 or 1	1	
17	Use External Compressor Trip-1 Signal Input (DI Channel 12). 0 = No, do not use this signal 1 = Yes, use this signal for compressor Trip-1 condition	0 or 1	0	
18	External Compressor Trip-1 State (DI Channel 12). 0 = Compressor Trip state when input is Off 1 = Compressor Trip state when input is On	0 or 1	0	
19	Use External Compressor Trip-2 Signal Input (DI Channel 13). 0 = No, do not use this signal 1 = Yes, use this signal for compressor Trip-2 condition	0 or 1	0	
20	External Compressor Trip-2 State (DI Channel 13). 0 = Compressor Trip state when input is Off 1 = Compressor Trip state when input is On	0 or 1	0	
21	Use External Compressor Trip-3 Signal Input (DI Channel 14). 0 = No, do not use this signal 1 = Yes, use this signal for compressor Trip-3 condition	0 or 1	0	
22	External Compressor Trip-3 State (DI Channel 14). 0 = Compressor Trip state when input is Off 1 = Compressor Trip state when input is On	0 or 1	0	
23	Use External Compressor Trip-4 Signal Input (DI Channel 15). 0 = No, do not use this signal 1 = Yes, use this signal for compressor Trip-4 condition	0 or 1	0	
24	External Compressor Trip-4 State (DI Channel 15). 0 = Compressor Trip state when input is Off 1 = Compressor Trip state when input is On	0 or 1	0	

10: Digital Output Channel Configuration

List 10 defines the signal state for the all of the digital output channels. The following table identifies the configuration parameters, range limits, and initial values.

Table 40 - Parameter List 10: Digital Output Channel Configuration

No.	Description	Range	Initial Value	User-configured Value
01	Compressor Trip Output (DO Channel 0). 0 = Normally de-energized, energize for compressor Trip 1 = Normally energized, de-Energize for compressor Trip	0 or 1	1	
02	Compressor Run Output (DO Channel 1). 0 = Normally de-energized, energize for compressor Run 1 = Normally energized, de-energize for compressor Run	0 or 1	0	
03	Ready-To-Start Output (DO Channel 2). 0 = Normally de-energized, energize for Ready-To-Start 1 = Normally energized, de-energize for Ready-To-Start	0 or 1	0	
04	System Trouble Output (DO Channel 3). 0 = Normally de-energized, energize for system trouble 1 = Normally energized, de-energize for system trouble	0 or 1	0	
05	Surge Alarm Output (DO Channel 4). 0 = Normally de-energized, energize for surge alarm 1 = Normally energized, de-energize for surge alarm	0 or 1	0	
06	Compressor Load Output (DO Channel 5). 0 = Normally de-energized, energize for compressor Load 1 = Normally energized, de-energize for compressor Load	0 or 1	0	

11: Compressor Configuration Information

List 11 defines general properties for the compressor configuration. These properties represent the following items.

- Base pressure and temperature of the manufacturer's compressor map
- Gas properties of the manufacturer's compressor map
- Base properties of the compressor Flow measurement
- Head calculation type for surge map data (polytropic or pressure ratio)
- Inlet guide vane usage and associated map technique.

The following table identifies the configuration parameters, range limits, and initial values.

Table 41 - Parameter List 11: Compressor Configuration Information

No.	Description	Range	Initial Value	User-configured Value
01	Compressor Base Temperature, Tbc. Enter in absolute temperature units (i.e. Kelvin or Rankin), matching the absolute correction units of any temperature transmitters.	0…999999	0	
02	Compressor Base Pressure, Pbc. Enter in absolute pressure units, matching the absolute correction units of the pressure transmitters.	0…999999	0	
03	Design Gas Ratio of Specific Heats, k (Cp/Cv).	0…2	0	
04	Compressor Polytropic Efficiency, Peff. Polytropic efficiency at surge point.	0…1	0	
05	Compressor Flow Device (Orifice) Base Temperature, Tbo. Enter in absolute temperature units (i.e. Kelvin or Rankin), matching the absolute correction units of any temperature transmitters, and the compressor base temperature.	0…999999	0	
06	Compressor Flow Device (Orifice) Base Pressure, Pbo. Enter in absolute pressure units, matching the absolute correction units of the pressure transmitters, and the compressor base pressure.	0…999999	0	
07	Max Flow Range, used for surge map Flow normalization. From the Rockwell Automation compressor toolset surge map definition.	0…999999	0	
08	Head Type, for surge map. Choices: 0 = HpSim, simplified polytropic Head 1 = Pratio, pressure ratio (Pd/Ps)	0 or 1	0	
09	Polytropic Exponent Calculation Type. Choices: 0 = Fixed/constant, calculated from k, and Peff 1 = Variable, calculated from actual pressures/temperatures using log ratios	0 or 1	0	
10	Variable Polytropic Exponent Max Limit. Used when polytropic exponent type set to “Variable.” Sets the max limit for the calculated value.	0…10	0	
11	Variable Polytropic Exponent Min Limit Used when polytropic exponent type set to “Variable.” Sets the min limit for the calculated value.	0 to 10	0	
12	Adjust Surge Map Using Inlet Guide Vanes. Choices: 0 = No, use the surge map without adjustment 1 = Yes, use inlet guide vane adjustment technique	0 or 1	0	
13	Inlet Guide Vane (IGV) Min Limit for Adjustment. Used when IGV adjustment technique is configured for use. Sets the min limit for the IGV adjustment.	0…100	0	
14	Design Gas Molecular Weight, MW. From compressor map, for reference only, not used in calculations.	0…200	0	
15	Design Gas Compressibility, Z. From compressor map, for reference only, not used in calculations.	0…2	0	

12: Surge Map Definition

List 12 defines the surge map for the compressor. The SSCC utilizes a ten-segment lookup table to represent the surge map plotting Head vs. Flow (normalized as $\%Q^2$). When the compressor includes inlet guide vanes (IGV), the IGV position is also configured for each point on the surge map.

The surge map values for Head and normalized Flow are typically generated using the Rockwell Automation compressor toolset. The toolset allows the user to enter values taken directly from the manufacturer's compressor map, and generates the Head (HpSim or Pratio) and Flow ($\%Q^2$) values required by the anti-surge control algorithms in the SSCC.

The following table identifies the configuration parameters, range limits, and initial values.

Table 42 - Parameter List 12: Surge Map Definition

No.	Description	Range	Initial Value	User-configured Value
01 02 03 04 05 06 07 08 09 10 11	X-axis Values ($\%Q^2$, 11 points), for compressor surge map. Values represent the Flow-squared, normalized over a Flow max range (referred to as %Q-squared, or $\%Q^2$). Values typically generated using the Rockwell Automation compressor toolset. Values must be ascending: Pt-0 <= Pt-1, Pt-1 <= Pt-2,…Pt-8 <= Pt-9, Pt-9 < Pt-10 When not all points are required, set each point in the list to 0.0, as required. For example, if only four points are defined, enter them at parameters 8…11 ($\%Q^2$ Pt-7…Pt-10), and prefill parameters 1…7 ($\%Q^2$ Pt-0…Pt-6) = 0.0.	0…100	0	
12 13 14 15 16 17 18 19 20 21 22	Y-axis Values (Head, 11 points), for compressor surge map. Values represent Head expressed in simplified polytropic Head, or pressure ratio (as identified in List 11, parameter 8). Values typically generated using the Rockwell Automation compressor toolset. Values must be ascending: Pt-0 <= Pt-1, Pt-1 <= Pt-2,…Pt-8 <= Pt-9, Pt-9 < Pt-10 When not all points are required, pre-fill the list as required. For example, if only four points are defined, enter them at parameters 19…22 (Head, Pt-7…Pt-10), and prefill parameters 12…18 = 0.0 (for HpSim) or = 1.0 (for Pratio).	0…100	0	
23 24 25 26 27 28 29 30 31 32 33	Inlet Guide Vane Values (IGV, 11 points), for compressor surge map. Applicable only for compressor with inlet guide vanes (IGV). Values represent IGV position expressed in %-open. Values typically generated using the Rockwell Automation compressor toolset. Values must be ascending: Pt-0 <= Pt-1, Pt-1 <= Pt-2,…Pt-8 <= Pt-9, Pt-9 < Pt-10 When not all points are required, pre-fill the list as required. For example, if only four IGV points are defined, enter them at parameters 30…33 (IGV, Pt-7…Pt-10), and prefill parameters 23…32 = 0.0 (IGV Pt-0…Pt-6).	0…100	0	

13: Surge and Margin Configuration

List 13 defines the surge detection and control margin properties. These properties establish the following items.

- Control margin calculations which set the distance between the surge limit line (SLL) and the control limit line.
- Surge detection methods, which detect surge based on changes to the operating point, either positionally (it falls below the SLL by a defined amount) or rate-of-change (it decreases rapidly, exceeding a falling low threshold).
- Operating point tracking, which establishes the surge control line (SCL) used as the setpoint for the anti-surge primary PID loop.

The following table identifies the configuration parameters, range limits, and initial values.

Table 43 - Parameter List 13: Surge and Margin Configuration

No.	Description	Range	Initial Value	User-configured Value
01	Base Offset Margin, %. The offset margin is one form of margin used to establish the distance from the surge limit line (SLL) to the control limit line (CLL). The base offset margin represents the min offset margin that will be used. The offset margin in use can be incrementally adjusted manually by the operator, or automatically on surge detection.	0…100	10	
02	Base Percent Margin, %. The percent margin is a second form of margin used to establish the distance from the SLL to the CLL. This margin contributes a percentage of the SLL value towards the total margin. Thus, the lower the SLL value, the smaller the percent margin contribution, and the higher the SLL value, the larger the percent margin contribution. Combining the percent margin with the offset margin provides great flexibility in total margin determination. The base percent margin represents the minimum percent margin that will be used. The percent margin in use can be incrementally adjusted manually by the operator, or automatically on surge detection.	0…100	20	
03	Maximum Margin Limit, %. This limit is applied individually to the offset margin in use, the percent margin in Use, as well as the calculated total margin in use.	0…100	30	
004	Margin Adjustment Amount, %. The margin in use can be incrementally adjusted by the operator or automatically when surge is detected. This parameter sets the amount of adjustment.	0…10	1	
05	Margin Adjustment Type. When margin in use is incrementally adjusted, this parameter specifies what form of margin is adjusted. Choices: 1 = Offset margin in use 2 = Percent margin in use 3 = Both offset and percent margin in use	1…3	1	
06	Backup Margin, %. The backup margin determines the limit for manual control of the anti-surge primary PID loop. If the distance between the operating point (OP) and the surge limit line (SLL) is less than the backup margin, then the anti-surge primary PID loop mode is forced to automatic to prevent the operator from driving the compressor into surge.	0…100	3	

Table 43 - Parameter List 13: Surge and Margin Configuration (Continued)

No.	Description	Range	Initial Value	User-configured Value
07	Backup and Surge Deadband, %. Sets the deadband used for the backup margin condition, and the positional surge alarm condition.	0…100	1	
08	Surge Trip Quantity. Quantity of surges for the multiple surge trip interlock.	0…10	4	
09	Surge Trip Time, seconds. The duration of time for the multiple surge trip interlock. If the quantity of surges (parameter 8) occur within this amount of time, the multiple surge trip interlock is generated, which triggers the compressor trip output.	0…600	30	
10	Surge Detection – Rate of Change Low Threshold (-%/sec). Establishes the rate-of-change (RoC) low threshold for operating point which is reported as a surge.	-99999…0	-25	
11	Surge Detection – Rate of Change Deadband (%/sec). A deadband used by the RoC calculation to clear the RoC surge condition.	099999	10	
12	Surge Detection – Rate-of-Change Time, milliseconds. Parameters 10, 11, and, 12 are used together to specify a surge detection method for rate-of-change (RoC) on the operating point (OP). The RoC of the OP is calculated every scan of the controller (set to 20 msec). The RoC maintains up to 50 samples of RoC values spanning up to 1 second (50 * 20 msec = 1000 msec). The RoC function calculates the average RoC over the time defined by parameter 12 by averaging the relevant quantity of samples. When this calculated average RoC is lower than the low threshold value (parameter10) a surge detection based on RoC is determined. This condition remains until the average RoC is greater than the RoC low threshold plus RoC deadband (parameter 11).	0…1000	200	
13	Surge Detection – Position Surge Margin, %. Positional surge is detected when the operating point falls below the surge limit line by this amount.	-100…0	-2	
14	Operating Point Track Margin, %. OP tracking establishes the surge control line (SCL). As the OP increases and moves to the right of the control limit line, the SCL may track the OP by this track margin.	0…100	5	
15	Operating Point Track Rate, %/sec. When the OP decreases back towards the CLL, this parameter determines the rate that the SCL is reduces back towards the CLL.	0…100	1	
16	Operating Point Track Max SP Limit, %. This parameter sets the maximum limit for the SCL. For example, with OP track max limit set to 75%, and the OP track margin set to 5.0%, the SCL will track the OP by 5% up to an OP value of 80%. At this point the SCL is tracking the OP at 75%. If the OP increases beyond 80%, the SCL remains limited at 75%.	0…100	75	

14: Run and Load Configuration

List 14 defines the properties used for compressor running determination and for manual/automatic loading for the compressor. Compressor running determination is normally based on the digital input (DIN) for compressor running (when a DI channel is configured for use).

Compressor running determination can also optionally be base on the following conditions.

- A head threshold
- An auxiliary control signal (e.g. motor amps) threshold
- An on-delay timer preset and off-delay timer preset for confirmed run status

The following table identifies the configuration parameters, range limits, and initial values.

Table 44 - Parameter List 14: Run and Load Configuration

No.	Description	Range	Initial Value	User-configured Value
01	Automatically Load compressor on Run condition. Choices: 0 = No 1 = Yes	0 or 1	0	
02	Use Auxiliary Control Signal for Run determination. Choices: 0 = No 1 = Yes	0 or 1	0	
03	Auxiliary Control Signal Threshold for Running, EU. When parameter 2 is set to "Yes," this parameter defines the threshold for the Run determination. Run condition if (AuxCntrlSig > Threshold) Example: For a motor driven compressor, the aux control signal analog input signal could be wired to a motor-amps transducer. If motor amps are greater than a set threshold, then the compressor is running.	-999999…999999	0	
04	Use Head for Run determination. Choices: 0 = No 1 = Yes	0 or 1	0	
05	Head Value Threshold for Running, EU. When parameter 4 is set to "Yes," this parameter defines the threshold for the Run determination. Run condition if (Head > Threshold)	0…100	0	
06	Confirmed Run Status On-delay Timer Preset, seconds. This value is the preset for the confirmed run status on-delay time. Until the compressor is confirmed running, loading is not permitted, and the anti-surge and capacity control devices are held at their override/unload/not running position. This on-delay timer applies to all options for Run condition, in other words, the Comp Run DI, AuxCntrlSig threshold, and Head threshold.	0…600	10	
07	Confirmed Run Status Off-delay Timer Preset, seconds. This value is the preset for the confirmed run status off-delay time. Once confirmed run status is set, running condition(s) must clear for this off-delay time before the confirmed run status is cleared.	0…60	1	

15: Anti-Surge Control General Configuration

List 15 defines general properties for anti-surge control that are independent from the primary and secondary anti-surge PID loops. These general configuration properties are used for the following controls.

- Anti-surge valve control value limits
- Anti-surge valve slew rate limits
- Ant-surge valve position deviation alarming
- Anti-surge PID loop min/max selection
- Anti-surge PID loop tracking

The following table identifies the configuration parameters, range limits, and initial values.

Table 45 - Parameter List 15: Anti-Surge Control General Configuration

No.	Description	Range	Initial Value	User-configured Value
01	Anti-surge PID Loop Output Min/Max Select Type. Choices: 0 = Minimum select 1 = Maximum select	0 or 1	1	
02	Not Running Control Value, % open. The anti-surge valve is set to this control value whenever the compressor is "Not Running" or "Unloaded." This value overrides the PID output values calculated by the primary or secondary anti-surge PID loops. If this value exceeds the min or max CV limits expressed in parameters 7 and 8, the min/max limited value is used under the "Not Running" or "Unloaded" condition.	0…100	100	
03	PID Track Margin, % Open. When both the primary and secondary anti-surge PID loops are configured, this value sets the tracking limit for the PID loop that is not producing the selected output. This keeps the non-controlling loop from winding up and moving away from the control value by more than a PID track margin. For example, if the PID track margin is set to 10%, the select type is set to "Maximum," the compressor is Running and Loaded, the primary PID loop output is max selected and at 60%, and the secondary PID loop output is 55% and reducing. If the secondary loop output reduces below 50% (60% - 10%) the secondary output is limited (tracks) at 50%. If the primary loop output increases to 61%, the secondary loop tracking rises to 51% (61% - 10%).	0…100	5	
04	Anti-surge Valve Location. Choices 0 = Blow-Off valve 1 = Recycle Valve This setting is used to modify the representation of the anti-surge valve connections on the Process Overview page of the Operator screen.	0 or 1	1	
05	Open Slew Rate, %/sec. Limits the opening rate of the control value. Normally, the anti-surge opening slew rate is set to allow fast opening.	0…999999	100	
06	Close Slew Rate %/sec. Limits the closing rate of the control value. Normally, the anti-surge closing slew rate is set to close the valve slowly.	0…999999	2	
07	Control Value Max Limit % Open. Sets the max limit for the control value for the valve.	0…100	100	

Table 45 - Parameter List 15: Anti-Surge Control General Configuration (Continued)

No.	Description	Range	Initial Value	User-configured Value
08	Control Value Min Limit, % Open. Sets the min limit for the control value for the valve.	0…100	0	
09	Incipient Surge Control Value Increment, % Open. On incipient surge detection, this control value is incremented by this amount. This increment is not subject to open slew rate limits. This increment serves to "bump" the anti-surge valve open more than the PID calculations are doing themselves when an incipient surge is detected. Note: This Incipient Surge Increment action requires that one of the multi-use analog input channels be configured for the SurgeGard signal input (see list 07: AIN - Multi-use Signal A on page 59 and list 08: AIN - Multi-use Signal B on page 60). Use the High Alarm of the configured channel for the incipient surge detection threshold.	0…100	10	
10	Valve Fail Direction. Choices: 0 = Closed (i.e. valve is air-to-open) 1 = Open (i.e. valve is air-to-close) Typically, the anti-surge valve is air-to-close, and fails open. This setting is used to generate the analog output signal direction from the control value which is always expressed as % open.	1	1	
11	Valve Position Deviation Alarm Deadband, %. When one of the multi-signal analog input channels is configured for anti-surge valve position feedback, the controller supports a position deviation alarm. This parameter sets the deadband limit for the alarm. When the difference between the control value and position feedback exceed this deadband, the deviation alarm timer is activated.	0…100	100	
12	Valve Position Deviation Alarm Time, seconds. This parameter is the preset for the deviation alarm timer. If the position deviation remains active for this time, the position deviation alarm is generated.	0…60	60	

16: ASC Primary PID Loop

List 16 defines the configuration settings for the anti-surge control primary PID loop. This PID loop is always configured and used for anti-surge control.

The process variable for this loop is always the calculated operating point (OP) value. The setpoint for this loop is always the surge control limit (SCL) value. Adaptive tuning is used for this loop (refer to List 17: ASC Primary PID Loop - Adaptive Integral on page 72 and List 18: ASC Primary PID Loop - Adaptive Proportional on page 73 for adaptive tuning configuration parameters).

The following table identifies the configuration parameters, range limits, and initial values. The initial values for these settings will usually not require changing.

Table 46 - Parameter List 16: ASC Primary PID Loop

No.	Description	Range	Initial Value	User-configured Value
01	Setpoint Tracks PV in Manual Mode. Choices: 0 = No 1 = Yes Keep this parameter set to 0. The setpoint is always set by the surge control line (SCL) value.	0 or 1	0	
02	Setpoint Maximum Limit, Engineering Units (% Operating Point). Keep this parameter set to 100. The SCL calculation by operating point tracking has its own maximum limit for OP tracking. Use that parameter to limit the maximum SCL and thus the setpoint for this loop. See 13: Surge and Margin Configuration on page 66, parameter 16.	0…100	100	
03	Setpoint Minimum Limit, Engineering Units (% Operating Point). Keep this parameter set to 0. The SCL calculation by OP tracking is always lower limited by the control limit line (CLL) value. There is no need to specify any other limitations on the setpoint for this loop.	0…100	0	
04	Setpoint Increment Rate Limit, EU/sec. Keep this parameter set to a large value. The SCL is allowed to increase as fast as possible, so there is no need to limit this setpoint increasing rate.	0…999999	10000	
05	Setpoint Decrement Rate Limit, EU/sec Keep this parameter set to a large value. The SCL decreasing rate is set by the OP track rate (See 13: Surge and Margin Configuration on page 66, parameter 15). There is no need to further limit this setpoint decreasing rate.	0…999999	10000	
06	PID Loop Deadband, Engineering Units (% Operating Point). Defines a deadband about the setpoint which treats error as 0, and thus no change to control value output. If used, normally kept small <= 1%	0…100	0	
07	Proportional Action Calculation Type. Choices: 0 = Calculate proportional based on change in PV 1 = Calculate proportional based on error Keep this parameter set to 1 for this loop.	0 or 1	1	
08	Use Interactive Tuning. Choices: 0 = No, Tuning parameters are non-interacting 1 = Yes, Tuning parameters are interacting (traditional) Use for the ASC primary PID loop, which uses adaptive tuning. Keep this parameter set to 0.	0 or 1	0	
09	Control Action. Choices: 0 = Reverse 1 = Direct Used for the ASC primary PID loop. Keep this parameter set to 0 for “Reverse.”	0 or 1	0	
10	PID Control Value (CV) Maximum Limit, % Open. Sets the maximum limit for the calculated PID control value output. Normally this parameter will be kept at 100.	0…100	100	
11	PID Control Value (CV) Minimum Limit, % Open Sets the minimum limit for the calculated PID control value output. Normally this parameter will be kept at 0.	0…100	0	

17: ASC Primary PID Loop - Adaptive Integral

List 17 defines the adaptive integral tuning properties used for the anti-surge control primary PID loop. The adaptive tuning parameters include the following feaetures.

- A base tuning value used when operating between breakpoints
- Tuning value minimum and maximum limits
- Breakpoints and slopes used to calculate the adaptive tuning value based on operating conditions

The following table identifies the configuration parameters, range limits, and initial values.

Table 47 - Parameter List 17: ASC Primary PID Loop – Adaptive Integral

No.	Description	Range	Initial Value	User-configured Value
01	Base Integral, Kbase, Repeats/minute. The base integral is the value used when operating within the breakpoints BP1 and BP2.	0…100	20	
02	Maximum Limit for Adaptive Integral, Kmax, Repeats/minute. The calculated adaptive integral is limited to this maximum value.	0…100	100	
03	Minimum Limit for Adaptive Integral, Kmin, Repeats/minute. The calculated adaptive integral is limited to this minimum value.	0…100	1	
04	Breakpoint 1, BP1, %. The distance below (negative) the CLL where adaptive tuning calculation adjustment begins.	-20…0	-1	
05	Breakpoint 2, BP2, %. The distance above (positive) the CLL where adaptive tuning calculation adjustment begins.	0…100	5	
06	Slope 1, S1, Repeat/min / % . The slope used for adaptive tuning adjustment below breakpoint 1.	0…100	10	
07	Slope 2, S2, Repeat/min / % . The slope used for adaptive tuning adjustment above breakpoint 2.	-100…100	2	

18: ASC Primary PID Loop - Adaptive Proportional

List 18 defines the adaptive proportional tuning properties used for the anti-surge control primary PID loop. The adaptive tuning parameters include the following features.

- A base tuning value used when operating between breakpoints
- Tuning value minimum and maximum limits.
- Breakpoints and slopes used to calculate the adaptive tuning value based on operating conditions.

The following table identifies the configuration parameters, range limits, and initial values.

Table 48 - Parameter List 18: ASC Primary PID Loop – Adaptive Proportional

No.	Description	Range	Initial Value	User-configured Value
01	Base Proportional, Kbase, Gain. The base proportional is the value used when operating within the breakpoints BP1 and BP2.	0…100	0.25	
02	Maximum Limit for Adaptive Proportional, Kmax, Gain. The calculated adaptive proportional is limited to this maximum value.	0…100	10	
03	Minimum Limit for Adaptive Proportional, Kmin, Gain. The calculated adaptive proportional is limited to this minimum value.	0…100	0.1	
04	Breakpoint 1, BP1, %. The distance below (negative) the CLL where adaptive tuning calculation adjustment begins.	-20…0	-1	
05	Breakpoint 2, BP2, %. The distance above (positive) the CLL where adaptive tuning calculation adjustment begins.	0…100	5	
06	Slope 1, S1, Gain / %. The slope used for adaptive tuning adjustment below breakpoint 1.	0…100	2	
07	Slope 2, S2, Gain / %. The slope used for adaptive tuning adjustment above breakpoint 2.	-100…100	-0.05	

19: ASC Secondary PID Loop

List 19 defines the configuration settings for the anti-surge control secondary PID loop. This PID loop is optional, and must be configured for use using this parameter list. The configuration parameters for this loop include the following settings.

- Selection of a process variable (PV) signal for the loop
- Setpoint and associated limits, ramp rates and behaviors
- Control settings (direct/reverse action, CV limits, deadband)
- Loop tuning configuration and values

When this loop has been configured for use, the loop output is available to the min/max selection for the anti-surge control. The selector chooses the configured min/max output of primary and secondary ASC PID loop outputs.

The following table identifies the configuration parameters, range limits, and initial values.

Table 49 - Parameter List 19: ASC Secondary PID Loop

No.	Description	Range	Initial Value	User-configured Value
01	Process Variable Selection. Choices: 0 = Not configured 1 = Q, Compressor Flow (AIN Channel 0) 2 = Ps, Suction Pressure (AIN Channel 1) 3 = Pd, Discharge Pressure (AIN Channel 2) 4 = Aux, Auxiliary Control Signal (AIN Channel 3) The scaled engineering unit value is used for the PV of the PID loop, and the engineering unit range of the analog input channel is used for the PID loop PV engineering units.	0…4	0	
02	Setpoint (EU). The setpoint for the PID loop. This value can be set here or using the PID loop faceplate. It is included here to allow it to be saved to the non-volatile memory of the HMI with the other parameters.	-999999…999999	0	
03	Setpoint Tracks PV when Loop is in Manual. Choices: 0 = No, Setpoint remains at its last value 1 = Yes, Setpoint tracks the PV value when loop is in manual	0 or 1	0	
04	Setpoint Maximum Limit (EU). Sets the maximum limit for the loop setpoint.	-999999…999999	0	
05	Setpoint Minimum Limit (EU). Sets the minimum limit for the loop setpoint.	-999999…999999	0	
06	Setpoint Increase Limit (EU/sec). Sets the increase ramp rate for the setpoint, in engineering units per second. For example, if set to 0.1, and the SP is changed from 70 to 80 psi, the SP in use will ramp from 70 to 80 at 0.1 psi-per-second. After 100 seconds, the SP will reach the value of 80 psi.	0…999999	10	
07	Setpoint Decrease Limit (EU/sec). Sets the decrease ramp rate for the setpoint, in engineering units per second. For example, if set to 2 and the SP is changed from 300 to 280 Amps, the SP in use will ramp from 300 down to 280 at 2 Amps-per-second. After 10 seconds, the SP will reach the value of 280.	0…999999	10	

Table 49 - Parameter List 19: ASC Secondary PID Loop (Continued)

No.	Description	Range	Initial Value	User-configured Value
08	Proportional Tuning value (Gain). Tuning value for the proportional action of the PID loop, in units of gain. Gain represents the percent control value per percent-error. For example, to create a 2% change of output for each %-error, set the gain to 2. This representation is the reciprocal of proportional band.	0…100	1	
09	Proportional Action based on PV or Error. Choices: 0 = PV, Proportional action is based on changes in the process variable. 1 = Error, Proportional action is based on error When based on error, the proportional action responds to changes in setpoint. When based on PV, the proportional action responds to changes in PV only, and is not affected by setpoint changes.	0 or 1	1	
10	Integral Tuning value (Repeats/minute)	0…100	2	
11	Derivative Tuning value (seconds)	0…100	0	
12	Interactive Tuning. Choices: 0 = Non-Interactive. The proportional gain value does not interact with the integral or derivative contributions. 1 = Interactive. The proportional gain is used to calculate the integral and derivative contributions. The setting of 1, “Interactive,” represents the traditional form of PID tuning behavior. In other words, increasing the gain also increases the integral and derivative contributions. The setting of 0, “Non-Interactive,” calculates the integral and derivative contributions independent of the proportional gain. The integral and derivative are calculated as if they have an effective gain of 1.	0 or 1	1	
13	PID Loop Control Action (a.k.a. Direction). Choices: 0 = Reverse Acting 1 = Direct Acting This parameter determines the direction the output moves in consequence to the direction the PV moves: Direct - An increasing PV will cause the output to increase Reverse - A increasing PV will cause the output to decrease	0 or 1	1	
14	PID Control Value (CV) Maximum Limit (% Open). The maximum limit imposed on the control value (output) calculated by the PID loop. Normally set to 100% open, but can be reduced if desired.	0…100	100	
15	PID Control Value (CV) Minimum Limit (% Open). The minimum limit imposed on the control value (output) calculated by the PID loop. Normally set to 0% open, but can be increased if desired.	0…100	0	
16	PID Deadband (EU). A deadband in PV engineering units above and below the loop setpoint. When the PV is within the deadband, the output of the PID loop is held at its present value and not updated.	0…999999	0	

20: Capacity Control General Configuration

List 20 defines general properties for capacity control that are independent from the primary and secondary capacity PID loops. These general configuration properties are used to define the following settings.

- Capacity device location/representation on Process Overview screen
- Capacity device control value limits
- Capacity device slew rate limits
- Capacity device position deviation alarming
- Capacity PID loop min/max selection
- Capacity PID loop tracking

The following table identifies the configuration parameters, range limits, and initial values.

Table 50 - Parameter List 20: Capacity Control General Configuration

No.	Description	Range	Initial Value	User-configured Value
01	Capacity PID Loop Output Min/Max Select Type. Choices: 0 = Minimum select 1 = Maximum select	0 or 1	0	
02	Not Running Control Value, % Open. The capacity device is set to this control value whenever the compressor is "Not Running" or "Unloaded." This value overrides the PID output values calculated by the primary or secondary capacity PID loops. If this value exceeds the min or max CV limits expressed in parameters 7 and 8, the min/max limited value is used under the "Not Running" or "Unloaded" condition.	0…100	0	
03	PID Track Margin, % Open. When both the primary and secondary capacity PID loops are configured, this value sets the tracking limit for the PID loop that is not producing the selected output. This keeps the non-controlling loop from winding up and moving away from the control value by more than a PID track margin. For example, PID track margin set to 8%, Select Type is set to minimum, compressor running and loaded, primary PID loop output is min selected and at 35%, secondary PID loop output is 40% and increasing. If the secondary loop output increases above 43% (35% + 8%) the secondary output is limited (tracks) at 43%. If the primary loop output decreases to 32%, the secondary loop tracking reduces to 40% (32% + 8%).	0…100	5	
04	Capacity Device Type and Location. Choices: 0 = Capacity control not required, show no device 1 = Suction valve throttling used for capacity control 2 = Inlet guide vane used for capacity control 3 = Discharge valve throttling used for capacity control 4 = Variable speed used for capacity control This setting is used to modify the location and representation of the capacity device on the Process Overview page of the Operator screen.	0…4	0	
05	Open Slew Rate, %/sec. Limits the opening rate of the control value. Normally, the capacity control opening slew rate is set for slow to moderate opening rate.	0 …999999	10	

Table 50 - Parameter List 20: Capacity Control General Configuration (Continued)

No.	Description	Range	Initial Value	User-configured Value
06	Close Slew Rate %/sec. Limits the closing rate of the control value. Normally, the capacity control closing slew rate is set for slow to moderate closing rate.	0 . . . 999999	10	
07	Control Value Maximum Limit, % Open. Sets the maximum limit for the control value for the device.	0. . . 100	100	
08	Control Value Minimum Limit, % Open. Sets the minimum limit for the control value for the device.	0. . . 100	0	
09	Valve Fail Direction. Choices: 0 = Closed (i.e. Valve is Air-to-Open) 1 = Open (i.e. Valve is Air-to-Close) Typically, the device is Air-to-Open, and fails closed. This setting is used to generate the analog output signal direction from the control value which is always expressed as % open.	0 or 1	0	
10	Device Position Deviation Alarm Deadband, %. When one of the multi-signal analog input channels is configured for capacity device position feedback, the controller supports a position deviation alarm. This parameter sets the deadband limit for the alarm. When the difference between the control value and position feedback exceed this deadband, the deviation alarm timer is activated.	0. . . 100	100	
11	Device Position Deviation Alarm Time, seconds. This parameter is the preset for the deviation alarm timer. If the position deviation remains active for this time, the position deviation alarm is generated.	0. . . 60	60	

21: Capacity Primary PID Loop

List 21 defines the configuration settings for the capacity control primary PID loop. This PID loop is optional, and must be configured for use using this parameter list. The configuration parameters for this loop include the following settings.

- Selection of a process variable (PV) signal for the loop
- Setpoint and associated limits, ramp rates and behaviors
- Control settings (direct/reverse action, CV limits, deadband)
- Loop tuning configuration and values

When this loop has been configured for use, the loop output is available to the min/max selection for the capacity control. The selector chooses the configured min/max output of primary and secondary capacity PID loop outputs.

The following table identifies the configuration parameters, range limits, and initial values.

Table 51 - Parameter List 21: Capacity Primary PID Loop

No.	Description	Range	Initial Value	User-configured Value
01	Process Variable Selection. Choices: 0 = Not configured 1 = Q, Compressor Flow (AIN Channel 0) 2 = Ps, Suction Pressure (AIN Channel 1) 3 = Pd, Discharge Pressure (AIN Channel 2) 4 = Aux, Auxiliary Control Signal (AIN Channel 3) The scaled engineering unit value is used for the PV of the PID loop, and the engineering unit range of the analog input channel is used for the PID loop PV engineering units.	0…4	0	
02	Setpoint (EU). The setpoint for the PID loop. This value can be set here or using the PID loop faceplate. It is included here to allow it to be saved to the non-volatile memory of the HMI with the other parameters.	-999999…999999	0	
03	Setpoint Tracks PV when Loop is in Manual. Choices: 0 = No, Setpoint remains at its last value 1 = Yes, Setpoint tracks the PV value when loop is in manual	0 or 1	0	
04	Setpoint Maximum Limit (EU). Sets the maximum limit for the loop setpoint.	-999999…999999	0	
05	Setpoint Minimum Limit (EU). Sets the minimum limit for the loop setpoint.	-999999…999999	0	
06	Setpoint Increase Limit (EU/sec). Sets the increase ramp rate for the setpoint, in engineering units per second. For example, if set to 0.1, and the SP is changed from 70 to 80 psi, the SP in use will ramp from 70 to 80 at 0.1 psi-per-second. After 100 seconds, the SP will reach the value of 80 psi.	0…999999	10	
07	Setpoint Decrease Limit (EU/sec). Sets the decrease ramp rate for the setpoint, in engineering units per second. For example, if set to 2 and the SP is changed from 300 to 280 Amps, the SP in use will ramp from 300 down to 280 at 2 Amps-per-second. After 10 seconds, the SP will reach the value of 280.	0…999999	10	

Table 51 - Parameter List 21: Capacity Primary PID Loop (Continued)

No.	Description	Range	Initial Value	User-configured Value
08	Proportional Tuning value (Gain). Tuning value for the proportional action of the PID loop, in units of gain. Gain represents the percent control value per percent-error. For example, to create a 2% change of output for each %-error, set the gain to 2. This representation is the reciprocal of proportional band.	0…100	1	
09	Proportional Action based on PV or Error. Choices: 0 = PV, Proportional action is based on changes in the process variable. 1 = Error, Proportional action is based on error When based on error, the proportional action responds to changes in setpoint. When based on PV, the proportional action responds to changes in PV only, and is not affected by setpoint changes.	0 or 1	1	
10	Integral Tuning value (Repeats/minute)	0…100	2	
11	Derivative Tuning value (seconds)	0…100	0	
12	Interactive Tuning. Choices: 0 = Non-Interactive. The proportional gain value does not interact with the integral or derivative contributions. 1 = Interactive. The proportional gain is used to calculate the integral and derivative contributions. The setting of 1, “Interactive,” represents the traditional form of PID tuning behavior,. In other words, increasing the gain also increases the integral and derivative contributions. The setting of 0, “Non-Interactive,” calculates the integral and derivative contributions independent of the proportional gain. The integral and derivative are calculated as if they have an effective gain of 1.	0 or 1	1	
13	PID Loop Control Action (a.k.a. Direction). Choices: 0 = Reverse Acting 1 = Direct Acting This parameter determines the direction the output moves in consequence to the direction the PV moves: Direct - An increasing PV will cause the output to increase Reverse - A increasing PV will cause the output to decrease	0 or 1	1	
14	PID Control Value (CV) Maximum Limit (% Open). The maximum limit imposed on the control value (output) calculated by the PID loop. Normally set to 100% open, but can be reduced if desired.	0…100	100	
15	PID Control Value (CV) Minimum Limit (% Open). The minimum limit imposed on the control value (output) calculated by the PID loop. Normally set to 0% open, but can be increased if desired.	0…100	0	
16	PID Deadband (EU). A deadband in PV engineering units above and below the loop setpoint. When the PV is within the deadband, the output of the PID loop is held at its present value and not updated.	0…999999	0	

22: Capacity Secondary PID Loop

List 19 defines the configuration settings for the capacity control secondary PID loop. This PID loop is optional, and must be configured for use using this parameter list. The configuration parameters for this loop include the following settings.

- Selection of a process variable (PV) signal for the loop
- Setpoint and associated limits, ramp rates and behaviors
- Control settings (direct/reverse action, CV limits, deadband)
- Loop tuning configuration and values

When this loop has been configured for use, the loop output is available to the min/max selection for the capacity control. The selector chooses the configured min/max output of primary and secondary capacity PID loop outputs.

The following table identifies the configuration parameters, range limits, and initial values.

Table 52 - Parameter List 22: Capacity Secondary PID Loop

No.	Description	Range	Initial Value	User-configured Value
01	Process Variable Selection. Choices: 0 = Not configured 1 = Q, Compressor Flow (AIN Channel 0) 2 = Ps, Suction Pressure (AIN Channel 1) 3 = Pd, Discharge Pressure (AIN Channel 2) 4 = Aux, Auxiliary Control Signal (AIN Channel 3) The scaled engineering unit value is used for the PV of the PID loop, and the engineering unit range of the analog input channel is used for the PID loop PV engineering units.	0…4	0	
02	Setpoint (EU). The setpoint for the PID loop. This value can be set here or using the PID loop faceplate. It is included here to allow it to be saved to the non-volatile memory of the HMI with the other parameters.	-999999…999999	0	
03	Setpoint Tracks PV when Loop is in Manual. Choices: 0 = No, Setpoint remains at its last value 1 = Yes, Setpoint tracks the PV value when loop is in manual	0 or 1	0	
04	Setpoint Maximum Limit (EU). Sets the maximum limit for the loop setpoint.	-999999…999999	0	
05	Setpoint Minimum Limit (EU). Sets the minimum limit for the loop setpoint.	-999999…999999	0	
06	Setpoint Increase Limit (EU/sec). Sets the increase ramp rate for the setpoint, in engineering units per second. For example, if set to 0.1, and the SP is changed from 70 to 80 psi, the SP in use will ramp from 70 to 80 at 0.1 psi-per-second. After 100 seconds, the SP will reach the value of 80 psi.	0…999999	10	
07	Setpoint Decrease Limit (EU/sec). Sets the decrease ramp rate for the setpoint, in engineering units per second. For example, if set to 2 and the SP is changed from 300 to 280 Amps, the SP in use will ramp from 300 down to 280 at 2 Amps-per-second. After 10 seconds, the SP will reach the value of 280.	0…999999	10	

Table 52 - Parameter List 22: Capacity Secondary PID Loop (Continued)

No.	Description	Range	Initial Value	User-configured Value
08	Proportional Tuning value (Gain). Tuning value for the proportional action of the PID loop, in units of gain. Gain represents the percent control value per percent-error. For example, to create a 2% change of output for each %-error, set the gain to 2. This representation is the reciprocal of proportional band.	0…100	1	
09	Proportional Action based on PV or Error. Choices: 0 = PV, Proportional action is based on changes in the process variable. 1 = Error, Proportional action is based on error When based on error, the proportional action responds to changes in setpoint. When based on PV, the proportional action responds to changes in PV only, and is not affected by setpoint changes.	0 or 1	1	
10	Integral Tuning value (Repeats/minute)	0…100	2	
11	Derivative Tuning value (seconds)	0…100	0	
12	Interactive Tuning. Choices: 0 = Non-Interactive. The proportional gain value does not interact with the integral or derivative contributions. 1 = Interactive. The proportional gain is used to calculate the integral and derivative contributions. The setting of 1, “Interactive,” represents the traditional form of PID tuning behavior. In other words increasing the gain also increases the integral and derivative contributions. The setting of 0, “Non-Interactive,” calculates the integral and derivative contributions independent of the proportional gain. The integral and derivative are calculated as if they have an effective gain of 1.	0 or 1	1	
13	PID Loop Control Action (a.k.a. Direction). Choices: 0 = Reverse Acting 1 = Direct Acting This parameter determines the direction the output moves in consequence to the direction the PV moves: Direct - An increasing PV will cause the output to increase Reverse - A increasing PV will cause the output to decrease	0 or 1	1	
14	PID Control Value (CV) Maximum Limit (% Open). The maximum limit imposed on the control value (output) calculated by the PID loop. Normally set to 100% open, but can be reduced if desired.	0…100	100	
15	PID Control Value (CV) Minimum Limit (% Open). The minimum limit imposed on the control value (output) calculated by the PID loop. Normally set to 0% open, but can be increased if desired.	0…100	0	
16	PID Deadband (EU). A deadband in PV engineering units above and below the loop setpoint. When the PV is within the deadband, the output of the PID loop is held at its present value and not updated.	0…999999	0	

23: Anti-Surge - Capacity Decoupling Configuration

List 23 defines the configuration settings used for decoupling the anti-surge and capacity controls. The following decoupling features are available.

- Useful when anti-surge control and capacity control are configured in the SSCC. If capacity control is not configured, these settings can be ignored.
- Management of the anti-surge and capacity controls so they do not "fight" each other at operating points near the control limit line.
- At operating points between the specified initiate and release points, the capacity control action is held, so the capacity controller does not drive the compressor to surge.
- This decoupling method allows the anti-surge controller to stabilize flow first, and then release the capacity control for further action when safe to do so.

The following table identifies the configuration parameters, range limits, and initial values.

Table 53 - Parameter List 23: Anti-Surge – Capacity Decoupling Configuration

No.	Description	Range	Initial Value	User-configured Value
01	Use Decoupling. Choices: 0 = No, do not use decoupling methods. 1 = Yes, use the decoupling methods	0 or 1	0	
02	Decoupling Initiate Point, DP1. This value defines the distance below the control limit line where decoupling action is Initiated. When the operating point moves below the control limit line by this distance, the capacity control output will be held. The value of DP1 should be further from 0 than DP2. In other words, DP1 < DP2 < 0.0	-100…0	-3	
03	Decoupling Release Point, DP2. This value defines the distance below the control limit line where decoupling action is released. When the operating point moves within this distance of the control limit line, the decoupling action is released, and the capacity control output is free to move normally. The value of DP2 should be closer to 0 than DP1. In other words, DP1 < DP2 < 0.0	-100…0	-1	

24: AINs - Substitute PV

List 24 defines whether to allow or dis-allow the use of substitute PV for each analog input channel. Substitute PV mode allows the user to override the actual measured and scaled analog input value with a substitute process value entered by the user.

The configuration setting for use of substitute PV mode is configured as one of the following values.

0 = Allow Substitute PV mode to be used

1 = Dis-Allow Substitute PV mode

The following table identifies the configuration parameters, range limits, and initial values.

Table 54 - Parameter List 24: AINs – Substitute PV

No.	Description	Range	Initial Value	User-configured Value
01	Compressor Flow, Q (AIN channel 0)	0 or 1	0	
02	Suction Pressure, Ps (AIN channel 1)	0 or 1	0	
03	Discharge Pressure, Pd (AIN channel 2)	0 or 1	0	
04	Auxiliary Control Signal, AuxCntrlSig (AIN channel 3)	0 or 1	0	
05	Suction Temperature, Ts, (AIN channel 4)	0 or 1	0	
06	Discharge Temperature, Td (AIN channel 5)	0 or 1	0	
07	Multi-Use Signal A, (AIN channel 6)	0 or 1	0	
08	Multi-Use Signal B, (AIN channel 7)	0 or 1	0	

25: DINs - Substitute PV

List 24 defines whether to allow or dis-allow the use of substitute PV for each digital input channel. Substitute PV mode allows the user to override the actual measured digital input value with a substitute process value entered by the user.

The configuration setting for use of substitute PV mode is configured as: one of the following values:

0 = Allow Substitute PV mode to be used

1 = Dis-Allow Substitute PV mode

The following table identifies the configuration parameters, range limits, and initial values.

Table 55 - Parameter List 25: DINs – Substitute PV

No.	Description	Range	Initial Value	User-configured Value
01	Compressor Run (DIN channel 0)	0 or 1	0	
02	Reset Push Button (DIN channel 1)	0 or 1	0	
03	Load Push Button (DIN channel 2)	0 or 1	0	
04	Unload Push Button (DIN channel 3)	0 or 1	0	
05	External Ready-to-Start 1 (DIN channel 8)	0 or 1	0	
06	External Ready-to-Start 2 (DIN channel 9)	0 or 1	0	
07	External Ready-to-Start 3 (DIN channel 10)	0 or 1	0	
08	External Ready-to-Start 4 (DIN channel 11)	0 or 1	0	
09	External Compressor Trip 1 (DIN channel 12)	0 or 1	0	
10	External Compressor Trip 2 (DIN channel 13)	0 or 1	0	
11	External Compressor Trip 3 (DIN channel 14)	0 or 1	0	
12	External Compressor Trip 4 (DIN channel 15)	0 or 1	0	

26: Reserved for Future Use

List 26 is not implemented on the HMI and is reserved for future use.

The following table identifies the configuration parameters, range limits, and initial values.

Table 56 - Parameter List 26: Reserved for Future Use

No.	Description	Range	Initial Value	User-configured Value
NA	This parameter list is not implemented on the HMI, and is reserved for future u.se	NA	NA	

27: Interlock Bypassable Configuration

List 27 contains the bypassable configuration for each of the interlocks for the compressor. When an interlock is configured as bypassable and bypasses are enabled, the interlock is bypassed and will not initiate the compressor trip.

Normally, the Interlock Configuration pop-up screen is used to set the interlock bypassable configuration. This parameter list is intended to allow this bypassable configuration to be saved to the non-volatile file memory of the HMI.

For each interlock, the bypassable configuration choice is 0 or 1.

0 = Not Bypassable

1 = Bypassable.

The following table identifies the configuration parameters, range limits, and initial values.

Table 57 - Parameter List 27: Interlock Bypassable Configuration

No.	Description	Range	Initial Value	User-configured Value
01	Multiple Surge Trip.	0 or 1	0	
02	Operating Point Fault.	0 or 1	0	
03 04 05 06 07 08	Spare Interlocks. Choices: These six Interlock positions are not presently used in the SSCC application.	0 or 1	0	
09	External Compressor Trip 1.	0 or 1	0	
10	External Compressor Trip 2.	0 or 1	0	
11	External Compressor Trip 3.	0 or 1	0	
12	External Compressor Trip 4.	0 or 1	0	
13 14 15 16	Spare Interlocks. These four Interlock positions are not presently used in the SSCC application.	0 or 1	0	

28: Permissive Bypassable Configuration

List 27 contains the bypassable configuration for each of the permissives for the compressor. When a permissive is configured as bypassable and bypasses are enabled, the permissive is bypassed and will not affect the ready-to-start condition.

Normally, the Permissive Configuration pop-up screen is used to set the permissive bypassable configuration. This parameter list is intended to allow this Bypassable configuration to be saved to the non-volatile file memory of the HMI.

For each permissive, the bypassable configuration choice is 0 or 1:.

0 = Not Bypassable

1 = Bypassable.

The following table identifies the configuration parameters, range limits, and initial values.

Table 58 - Parameter List 28: Permissive Bypassable Configuration

No.	Description	Range	Initial Value	User-configured Value
01	Control Loops Ready.	0 or 1	0	
02	Anti-Surge Valve Ready.	0 or 1	0	
03	Capacity Valve/Inlet Guide Vane Ready.	0 or 1	0	
04	Spare Permissive. These four Interlock positions are not presently used in the SSCC application.	0 or 1	0	
05	Digital Inputs OK.	0 or 1	0	
06	Analog Inputs OK.	0 or 1	0	
07	Digital Outputs OK.	0 or 1	0	
08	Analog Outputs OK.	0 or 1	0	
09	External Ready-to-Start 1.	0 or 1	0	
10	External Ready-to-Start 2.	0 or 1	0	
11	External Ready-to-Start 3.	0 or 1	0	
12	External Ready-to-Start 4.	0 or 1	0	
13 14 15 16	Spare Permissives. These four permissive positions are not presently used in the SSCC application.	0 or 1	0	

29: Modbus Serial Port Configuration

List 29 defines the settings used for the Modbus serial port configuration. These parameters are used for the following settings.

- Set the slave ID and register scaling configuration
- Set the serial port baud rate and parity
- Read back the serial port baud rate and parity

The following table identifies the configuration parameters, range limits, and initial values.

Table 59 - Parameter List 29: Modbus Serial Port Configuration

No.	Description	Range	Initial Value	User-configured Value
01	Slave ID. The slave ID number identifies the controller number on a Modbus multi-drop serial link. Each controller on the multi-drop link has a unique slave ID.	1…254	1	
02	Register Scaling Range. The internal engineering unit values in the controller are scaled to this integer range for sending over the Modbus protocol. Refer to Modbus Holding Registers on page 160 for details on the engineering unit ranges for Modbus variables.	1000…32767	32767	
03	Baud Rate Configuration. Enter the desired baud rate for the Modbus serial port. Use parameter 7 of this list to trigger setting the port to this baud rate.	110, 300, 600, 1200, 2400, 4800, 9600, 19200, or 38400	19200	
04	Parity Configuration. Enter the code to the right for the desired parity for the Modbus serial port. Use parameter 7 of this list to trigger setting the port to this parity.	0 = No Parity 1 = Odd Parity 2 = Even Parity		
05	Baud Rate Readback. Leave the value of this parameter set to 0 (read only parameter). The CURR column reads back the actual baud rate in use on the controller.	110, 300, 600, 1200, 2400, 4800, 9600, 19200, or 38400	0	
06	Parity Readback. Leave the value of this parameter set to 0 (read only parameter). The CURR column reads back the actual parity in use on the controller.	0 = No Parity 1 = Odd Parity 2 = Even Parity	0	
07	Set Port Configuration. Set this value to 1 to trigger setting the serial port. Note: The controller always clears this value after setting the port, so the CURR column will always read back a 0 value.	0 or 1	0	

30: Application (HMI Configuration)

List 30 defines key properties for the HMI application. These parameters are used for the following settings.

- The maximum number of pages to support on various HMI screens
- To permit or deny the use of interlock/permissive bypasses for the system

The following table identifies the configuration parameters, range limits, and initial values.

Table 60 - Parameter List 30: Application (HMI-related Configuration)

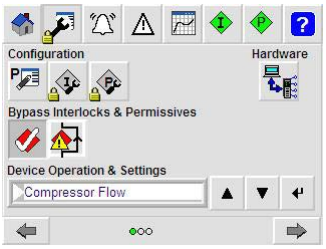
No.	Description	Range	Initial Value	User-configured Value
01	Maximum Operator Screens Sets the number of pages for the Operator screen. DO NOT CHANGE UNLESS ADVISED BY FACTORY.	0…8	6	
02	Maximum Maintenance Screens Sets the number of pages for the Maintenance screen. DO NOT CHANGE UNLESS ADVISED BY FACTORY.	0…8	3	
03	Maximum Warning Screens Sets the number of pages for the Warnings screen. DO NOT CHANGE UNLESS ADVISED BY FACTORY.	0…8	2	
04	Maximum Interlocks Screens Sets the number of pages for the Interlocks screen. DO NOT CHANGE UNLESS ADVISED BY FACTORY.	0…8	2	
05	Maximum Permissives Screens Sets the number of pages for the Permissives screen. DO NOT CHANGE UNLESS ADVISED BY FACTORY.	0…8	2	
06	Maximum Help Screens Sets the number of pages for the Operator screen. DO NOT CHANGE UNLESS ADVISED BY FACTORY.	0…8	8	
07	Maximum Status Screens Sets the number of pages for the Hardware Status screen. DO NOT CHANGE UNLESS ADVISED BY FACTORY.	0…8	3	
08	Maximum IO Cards Sets the number of IO modules presented in the IO module selector Hardware Status screen. DO NOT CHANGE UNLESS ADVISED BY FACTORY.	0…8	4	
09	Bypass Enable. Choices: 0 = Disable 1 = Enable This parameter is presented in the list, so that the current status of bypass enable/disable can be saved to the non-volatile file memory for archive. To enable and disable the bypasses, parameter 10 must be set to 1, and then use the Enable and Disable buttons on the Maintenance screen.	0 or 1	0	
10	Has Bypass. Choices: 0 = No, Hide the Bypass Enable/Disable buttons on the HMI 1 = Yes, Present Bypass Enable/Disable buttons on the Maintenance screen of the HMI If you want to configure and allow bypassing of interlocks and permissives on the HMI, then this parameter must be set to 1.	0 or 1	0	

Parameter List Configuration

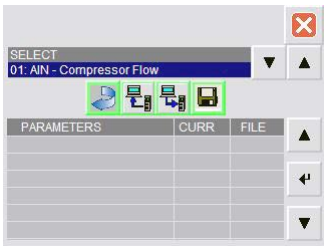
Parameter lists are configured using the Parameter Configuration screen on the HMI. Follow these steps to access the parameter lists on the Parameter Configuration screen.

1. Press to close any open pop-up screens and return to a main screen showing the navigation toolbar.
2. Press on the navigation toolbar.

   The Maintenance screen appears.
3. Press to page forward, or to page backward, as required to navigate to page one of the Maintenance screen (shown here).

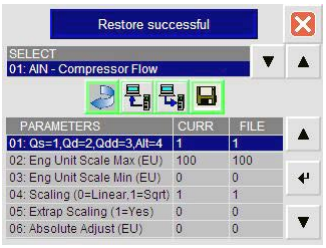


4. Press to open the Parameter Configuration pop-up screen (shown here).



Parameter Configuration Screen Overview

Table 61 - Parameter Configuration Screen



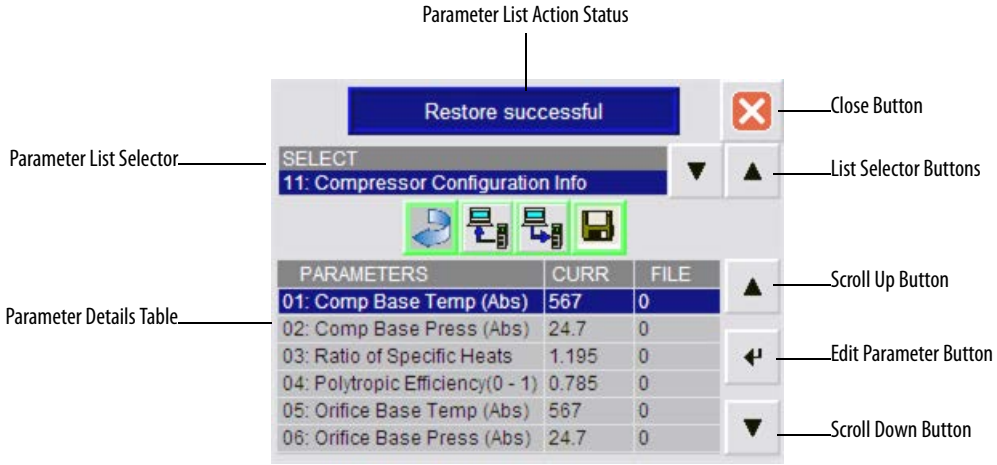
Display Features (see Figure 9 for the location of these features):

- Parameter list selector
- Parameter list action buttons
- Parameter details table
- Parameter list action status (For example: Restore successful)

Operational Features:

- Press ▲ ▼ to the right of the Select field to choose a parameter list.
- Press to update the parameter details table - security privilege required (O, S, M, E, or A).
- Press to upload values from the controller and store them in the HMI file memory – security privilege required (E, or A).
- Press to download values from HMI file memory to the controller – security privilege required (E, or A).
- Press to save parameter value changes entered from the HMI to the HMI file memory – security privilege required (E, or A).
- Press ▲ or ▼ to the right of the parameter details table to choose a parameter.
- Press ↵ to the right of the parameter details table to edit the value for a selected parameter – security privilege required (E, or A). This opens the on-screen keypad for data entry.

Figure 9 - Parameter Configuration Screen Components



Parameter List Actions

The functions performed when using the parameter list action buttons are illustrated in Figure 10 and explained in detail in Table 62.

Figure 10 - Parameter List Action Details

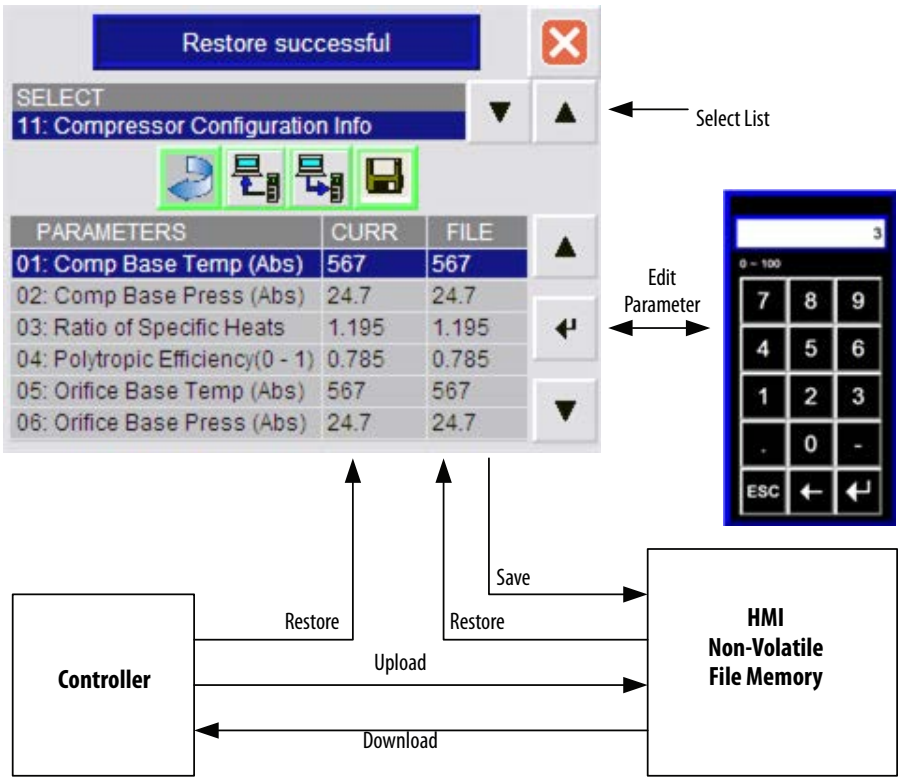


Table 62 - Parameter List Actions Details

Button	Action	Security	Operation Performed on the Selected Parameter
	Restore	O, S, M, E, or A	Updates the Parameter Details table screen values: • Parameter names are read from the HMI file memory. • CURR value is read from the controller (read once, not continuous). • FILE value is read from the HMI file memory.
	Upload	E or A	Reads values from the controller and stores them in the HMI file memory. • Clicking Upload does not update screen values. • After an upload, click Restore to view uploaded values on the screen.

Table 62 - Parameter List Actions Details (Continued)

Button	Action	Security	Operation Performed on the Selected Parameter
	Download	E or A	Writes values from the HMI file memory to the controller. • Clicking the Download button does not write values from the screen to the controller and does not read values from the controller (doesn't update CURR column). • If you have modified values on the screen using Edit Parameter, then use Save before a download. • After a download use Restore to update CURR values from the controller.
	Save	E or A	Saves all the screen values for the current parameter list to the HMI file memory. This function is normally used after making changes using Edit Parameter. • Does not save CURR values (from the controller) to the HMI file memory. • If you want to save controller values to the HMI file memory, use Upload.
	Edit Parameter	E or A	Modifies the value presented on screen in the FILE column. • Does not change the value in the Controller. • Does not change the value in the HMI file memory. • After making changes using Edit Parameter, use Save to write the changed parameter values to the HMI file memory.

When working with the parameter lists, you will typically complete a sequence of actions to accomplish the desired task. Use the following table to identify the task you want to complete and the recommended sequence of actions.

What Task Do You Want to Accomplish?	Recommended Action Sequence
I want to view parameter configuration settings.	1. Select the desired parameter list. 2. Click Restore to update the parameter table. 3. Scroll as required to view parameter values.
I want to configure parameters for a new system.	For each parameter list: 1. Select the desired parameter list. 2. Click Restore to update the parameter table on the screen. 3. For each parameter in the list, click Edit Parameter to set the desired value. 4. Click Save to save the configuration to the HMI file memory. 5. Click Download to download the configuration to the controller. 6. Click Restore to confirm the controller values.
I want to modify settings currently in use in the present controller.	Is your compressor running? • Yes: You cannot use the Parameter Configuration screen to make changes. Instead, you can use the device faceplates on the HMI to change many configuration parameters. • No: Perform the following steps: 1. Select a parameter list. 2. Click Restore to update the parameter table. 3. Review the table to determine if the parameter you want to change in this list. If so continue, if not return to step 1. 4. Click Upload to read the controller values to the HMI file memory. 5. Click Restore to update the parameter table (FILE column is updated from the Upload). 6. Scroll to the parameter(s) you want to change, enter the desired value, and click Edit Parameter. 7. Click Save to save the changes to the HMI file memory. 8. Click Download to download the configuration to the controller. 9. Click Restore to confirm the controller parameter values.

What Task Do You Want to Accomplish?	Recommended Action Sequence
I have changed settings in the controller using device faceplates on the HMI. Now I want to save the controller values to the HMI file memory.	Is your compressor running? • Yes: Wait until the compressor stops. • No: Complete the following steps: For each parameter list: 1. Select the desired parameter list. 2. Click Upload to upload the controller values to the HMI file memory. 3. Optional: Click Restore to update the parameter table values on the HMI screen. You can verify that the CURR and FILE values now match.
I have replaced my controller, and it is loaded with the default SSCC Logix application and settings. All my configured settings are saved in the HMI file memory. I want to apply all my settings in the HMI to the controller.	If you have replaced the controller, you may need to re-activate the HMI. Refer to Activate the HMI on page 25. If your HMI is successfully activated, follow these steps for each parameter list: 1. Select the desired parameter list. 2. Click Restore to display the contents of the list on the HMI screen. 3. Review the list, checking that the FILE column has the intended values. 4. Click Download to download the values to the controller. 5. Click Restore to refresh the list on the screen. 6. Review and confirm that the CURR values (from the controller) now match the FILE values (from the HMI file memory).
All my settings are saved in the HMI file memory. I want to make an archive copy to a compact flash memory card.	In order to make an archive copy to a compact flash memory card, the normal HMI color graphics must be shut down to allow access the PanelView Plus file utilities. During this time, the HMI will be unavailable for compressor operation. Follow these steps to shut down the HMI graphics – security privilege will be required. 1. Navigate to page 1 of the Maintenance screen. 2. Press to display the Hardware Status screen. 3. Scroll to page 3 f the Hardware Status screen for PanelView maintenance. 4. Press to shutdown the HMI graphics. Consult the PanelView Plus user manual for details on accessing the file utilities to copy the HMI application file to your compact flash card.

Interlock and Permissive Customization

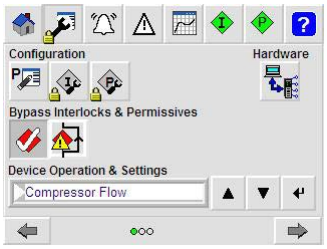
The SSCC system has pre-allocated input signals for use as interlocks and permissives for the compressor. These signals appear in the Interlocks and Permissive screens with initial names which may be customized. Interlock Configuration and Permissive Configuration screens allow for customizing these signals.

Follow these steps to navigate to the Maintenance screen, and open the Interlocks Configuration or Permissives Configuration screen.

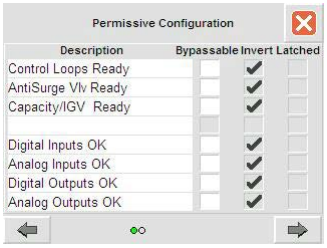
1. Press to close any open pop-up screens and return to a main screen showing the navigation toolbar.
2. Press on the navigation toolbar.

   The Maintenance screen appears.

3. Press → to page forward, or ← to page backward, as required to navigate to page one of the Maintenance screen (shown here).



4. Press or to open the desired Configuration pop-up screen (example Permissive Configuration screen shown here).

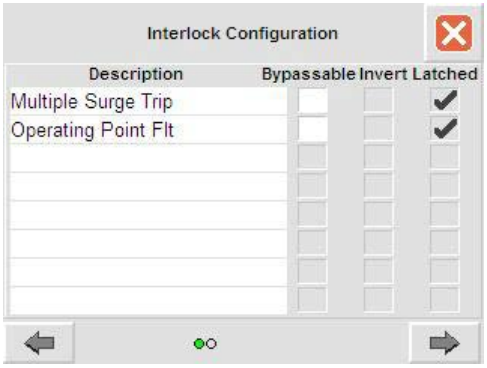


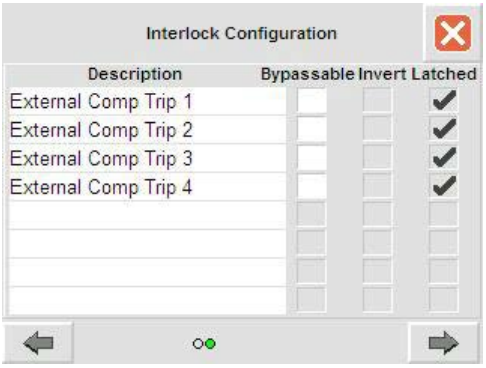
Note: The Configuration buttons always contain a lock symbol, as some of their configuration features (invert and latched) are set in the system design and cannot be changed.

Interlock Configuration Screen

The Interlock Configuration screen has two pages. Page 1 contains interlocks internal to the SSCC controller; page 2 contains interlocks external to the controller. Use the screen navigation arrow keys at the bottom to navigate between the two pages.

Figure 11 - Interlock Configuration Screens with Default Settings





Customizing Interlocks

From the configuration screen, you can edit the interlock description. These represent string tags in the HMI (not the controller). These tags are retentive and saved in the HMI memory.

You are encouraged to customize the external interlock descriptions on page 2, to provide a more functional description. For example, you may connect a lube oil low pressure switch interlock, and therefore change the associated interlock description (e.g. “Low Lube Oil Press”). Editing the description requires security privileges (Engineer or Administrator). The description string tag limit is 20 characters.

Configuring Interlock Bypasses

Each interlock has a configuration option for “Bypassable.” The bypassable setting on this screen is the same as that configured in parameter List 27: Interlock Bypassable Configuration. Changing the bypassable setting requires security privileges (Engineer or Administrator).

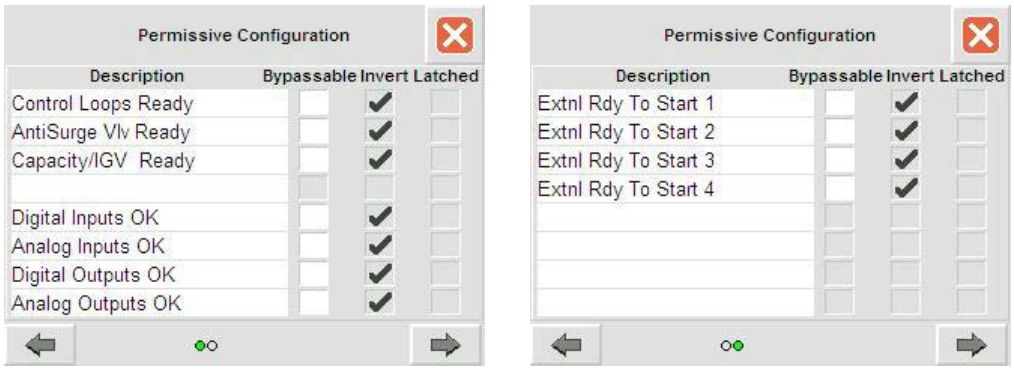
An interlock is bypassed when:

1. The interlock is configured as “Bypassable,” and
2. Bypass is enabled on the Maintenance screen.

Permissive Configuration Screen

The Permissive Configuration screen has two pages. Page 1 contains permissives internal to the SSCC controller; page 2 contains permissives external to the controller. Use the screen navigation arrow keys at the bottom to navigate between the two pages.

Figure 12 - Persmissive Configuration Screens with Default Settings



Customizing Permissives

From the configuration screen, you may edit the permissive descriptions. These represent string Tags in the HMI (not the controller). These tags are retentive and saved in the HMI memory.

You are encouraged to customize the external permissive descriptions on page 2, to provide a more functional description. For example, you may connect a Lube Oil Auxiliary Pump Running permissive, and therefore change the associated permissive description (e.g. “Aux Lube Pump Run”). Editing the description requires security privileges (Engineer or Administrator). The description string tag limit is 20 characters.

Configuring Permissive Bypasses

Each permissive has a configuration option for “Bypassable.” The bypassable setting on this screen is the same as that configured in parameter list 28: Permissives Bypassable Configuration. Changing the bypassable setting requires security privileges (Engineer or Administrator).

A permissive is bypassed when:

1. The permissive is configured as “Bypassable,” and
2. Bypass is enabled on the Maintenance screen.

SSCC Operation

This section provides details for the main Operation screens and guides you through the process of putting the SSCC in operation.

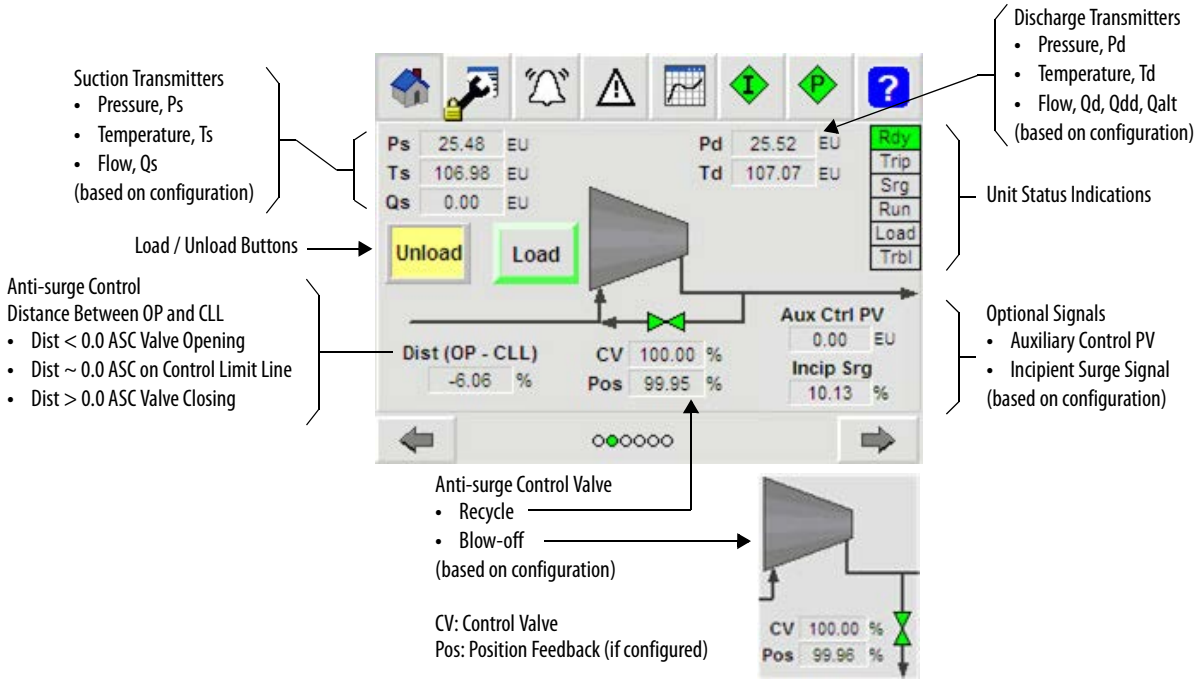
Operation Screen Details

The main Operator screen has many visualization features that are based on choices made during configuration. This section provides details about these features.

Compressor Overview

The Compressor Overview is page 2 of the Operator screen. This screen provides a process diagram overview of the compressor and the configured instrumentation. Key features for anti-surge control are represented in the following illustration.

Figure 13 - Compressor Overview Page



The suction and discharge transmitters presented on the screen are based on the individual analog input channel configuration options. The units displayed for each transmitter (default "EU" shown) follow the unit string customization available on the analog input device faceplates.

The algorithm for anti-surge control calculates the operating point (OP). The instrumentation requirements are based on the type of flow measurement configured. These requirements are reflected in the following table.

Flow Configuration	Suction Transmitters		Discharge Transmitters	
	Pressure, Ps Ps 25.47 EU	Temperature, Ts Ts 106.94 EU	Pressure, Pd Pd 25.53 EU	Temperature, Td Td 107.07 EU
Flow in Suction Qs 0.00 EU	Required	Optional	Required	Optional
Flow in Discharge, no coolers Qd 0.00 EU	Required	Optional	Required	Optional
Flow in Discharge, downstream of coolers Qdd 0.00 EU	Required	Required	Required	Required
Alternate measurement Qalt 0.00 EU	Required	Optional	Required	Optional

Unit Status Indicators

The unit status indicators along the right side of the page reflect key operational controls/indications and correspond to the unit's digital outputs. The indications presented on the screen are detailed in Table 63.

Table 63 - Unit Status Indicator Descriptions

Status	Digital Output	Status Indicator and Description	
Ready	Ready to Start, DO channel 3	Rdy	Not Ready-to-Start, check permissives
		Rdy	Ready-to-Start, all permissives OK
Trip	Comp Trip Interlock, DO channel 0	Trip	Not Tripped, all interlocks OK
		Trip	Compressor Trip, check interlocks
Surge	Surge Alarm, DO channel 1	Srg	Normal, no surge alarm
		Srg	Surge alarm activated
Run	Compressor Running, DO channel 4	Run	Not Running, no Run condition detected
		Run	Confirmed Run determination
Load	Compressor Loaded, DO channel 5	Load	Unloaded, valves at override CV value
		Load	Loaded, valves released for control
Trouble	System Trouble Alarm, DO channel 2	Trbl	Normal
		Trbl	System trouble, hardware or device fault

Load / Unload Control Buttons

The Load and Unload buttons provide both control and indication of the control mode for the compressor. When unloaded, the SSCC drives the control valves to their configured override position. When loaded, the SSCC is allowed to control the valves based on the configured PID regulatory controls. The load/unload modes and indications are detailed in Table 64.

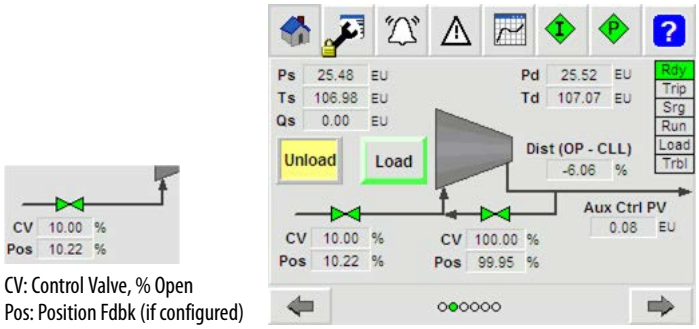
Table 64 - Load / Unload Control Button Descriptions and Operations

Buttons		Indication Description	Button Operation Available
Unload	Load	Unload mode – Valve control set to override CV value	None, security privilege required (O, S, M or E).
Unload	Load	Load mode – Valve control released for regulatory control	None, security privilege required (O, S, M or E).
Unload	Load	Unload mode – Valve control set to override CV value	Press Load to switch to Load mode.
Unload	Load	Load mode – Valve control released for regulatory control	Press Unload to switch to Unload mode.

Capacity Control Visualization

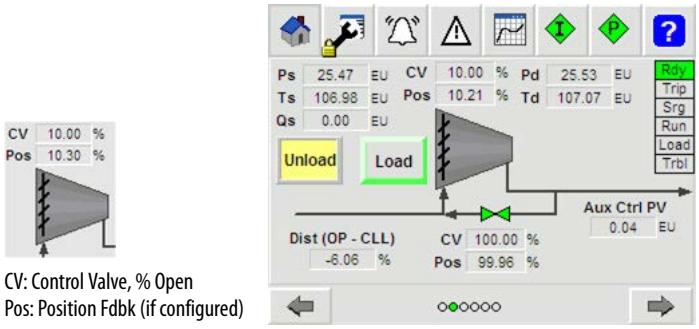
When capacity control is configured, the capacity control type is visualized on the Compressor Overview page. The various capacity configuration options and visualization arrangements are detailed in the following illustrations.

Figure 14 - Capacity Control Type: Suction Throttling Example



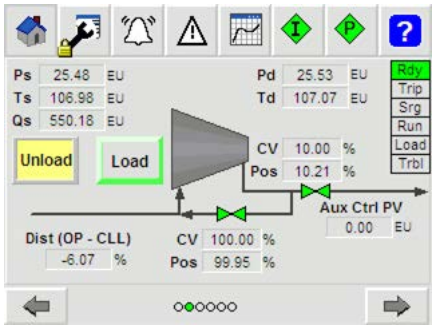
CV: Control Valve, % Open
Pos: Position Fdbk (if configured)

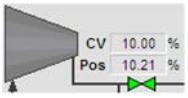
Figure 15 - Capacity Control Type: Inlet Guide Vanes Example



CV: Control Valve, % Open
Pos: Position Fdbk (if configured)

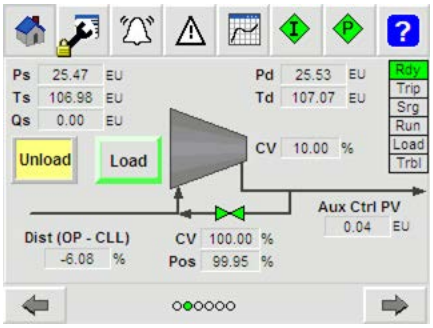
Figure 16 - Capacity Control Type: Discharge Throttling Example

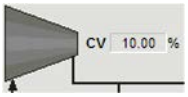




CV: Control Valve, % Open
Pos: Position Fdbk (if configured)

Figure 17 - Capacity Control Type: Speed Setpoint to Speed Controller Example



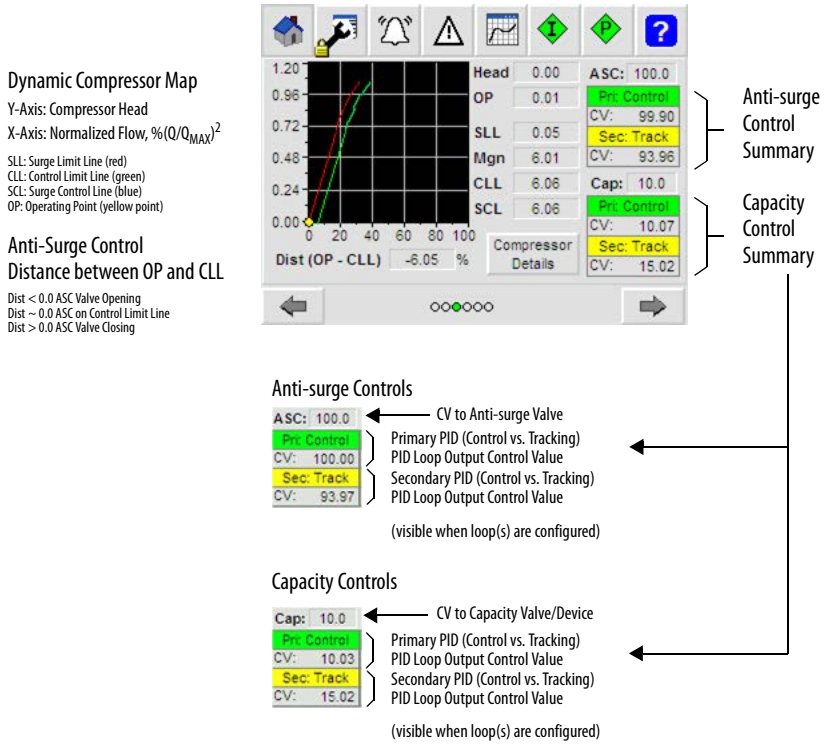


CV: Speed Setpoint, where:
0% = Minimum Governor
100% = Maximum Governor

Compressor Map

The Compressor Map is page 3 of the Operator screen. It provides a dynamic X-Y plot for the compressor map, key anti-surge calculated values (head, OP, SLL, CLL, SCL, and margin) and summary status for the anti-surge and capacity control signals. Key features of the Compressor Map page are represented in the following illustration.

Figure 18 - Compressor Map Page Example

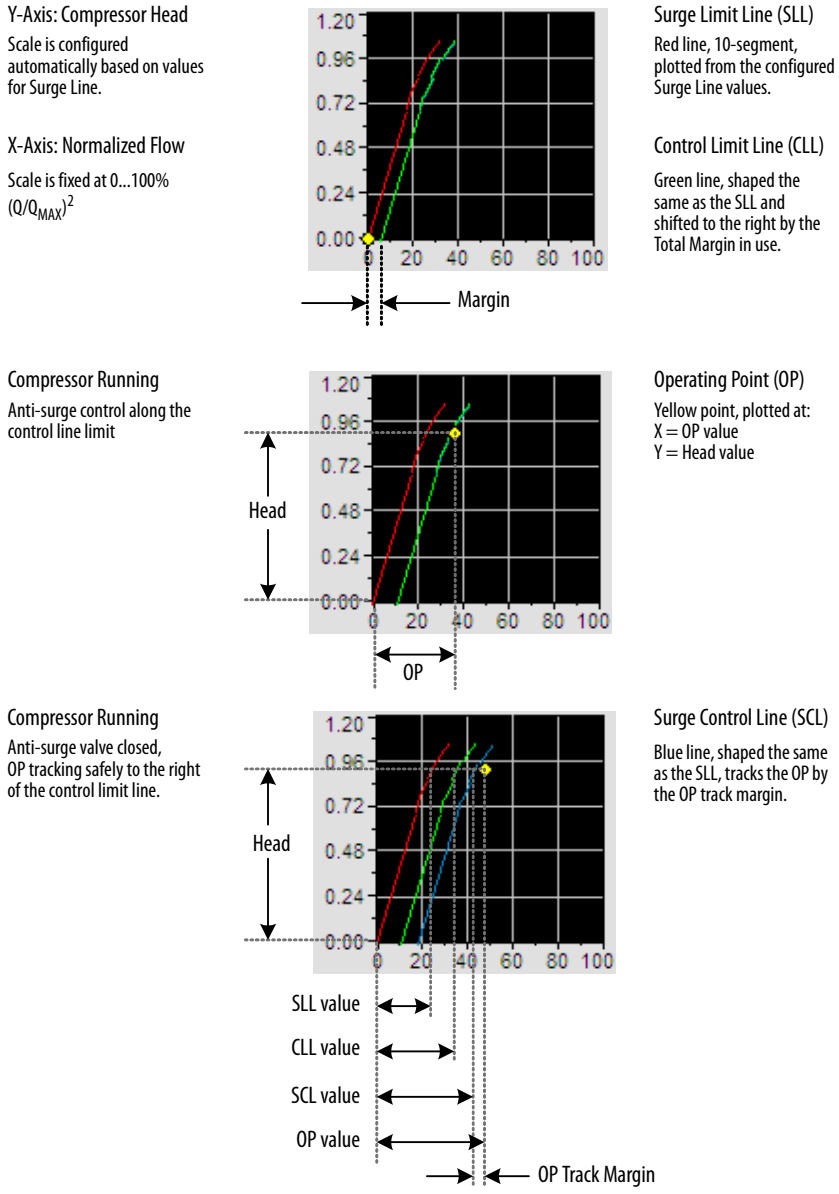


Dynamic Compressor Map

The dynamic compressor map provides real-time presentation of the surge limit line, control limit line, surge control limit line (OP tracking), and the live operating point. This visualization provides a clear view of where the compressor is operating relative to surge and control limits, and how much margin is in use.

Further details of the compressor map are shown in the following illustration.

Figure 19 - Dynamic Compressor Map Example

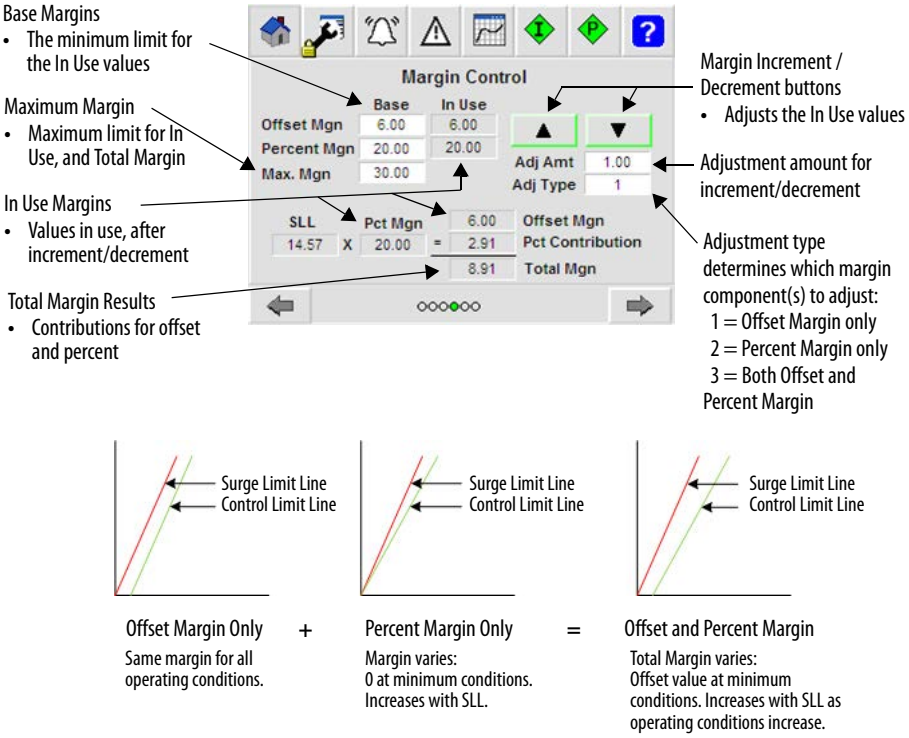


Margin Control

For the primary anti-surge PID, the setpoint is dynamic based on operating conditions and is automatically generated by the functional components of the algorithm. The operator does not directly enter the setpoint. However, the operator can influence the setpoint through adjustment of the margin. Margin adjustments are managed on the Margin Control page four of the Operator screen.

Key features of the Margin Control page are represented in the following illustration.

Figure 20 - Compressor Map Page Example



Margin Configuration

The Margin Control page provides access to certain margin configuration properties from the configuration parameter list 13: Surge and Margin Configuration. A cross reference between the operator page and the parameter list is included here.

Screen Configuration Item	Security	Parameter List Cross Reference List 13: Surge and Margin Configuration
Offset Margin	M, E or A	01: Base Offset Margin (%)
Percent Margin	M, E or A	02: Base Percent Margin (%)
Maximum Margin	M, E or A	03: Max Margin Limit (%)
Adjust Amount	M, E or A	04: Margin Adj Amount (%)
Adjust Type	M, E or A	05: Adj (1=Ofst, 2=Pct, 3=Both)

Margin Increment / Decrement

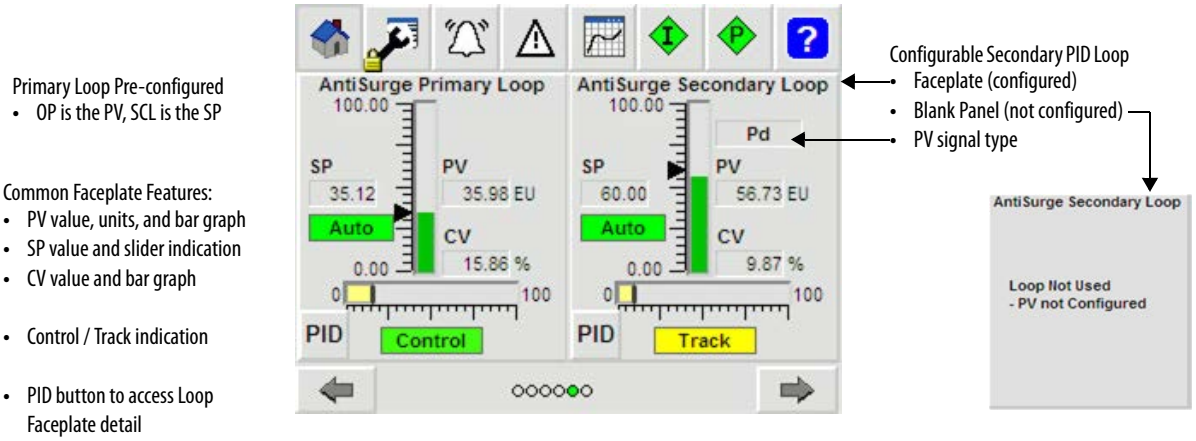
The anti-surge algorithm automatically increments the margin "in use" values whenever a surge is detected. The margin "in use" values may also be manually adjusted using ▲ and ▼ on the screen – security privilege required (O, S. M, E, or A). The adjustment amount and type are applied to these increments and decrements. The margins cannot be decremented less than the configured base margins, and cannot be incremented larger than the maximum margin limit.

Anti-Surge Control PID Loops Overview

Anti-surge control is provided through a primary PID loop configured to control the operating point relative to the surge control line. In addition, a secondary PID loop can be optionally configured, often based on suction pressure or discharge pressure.

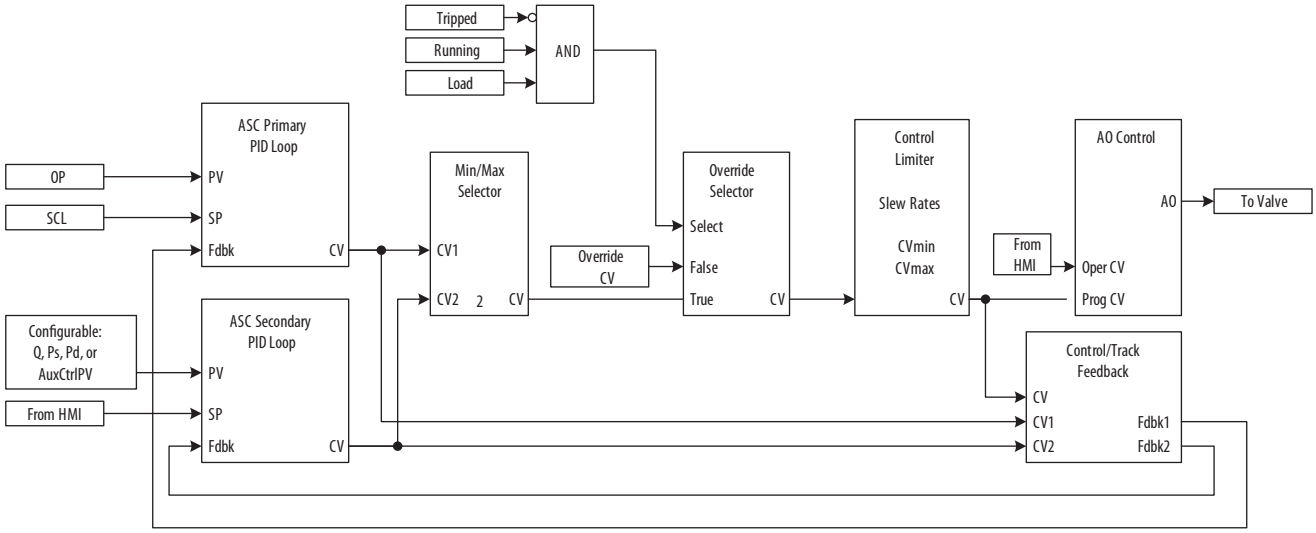
Page 5 of the Operator screen provides an overview of these two anti-surge control PID loops.

Figure 21 - Operator Screen Page 5 Example



There are no direct operation features on this page. To operate or tune the loops, press PID to open the individual PID loop faceplate. More details on the PID faceplate are provided later in this chapter.

These two PID loop are managed together through a min/max selector, control override selector, and a control limiter to create a final control value for the anti-surge control valve. These control features are illustrated in the following function diagram.

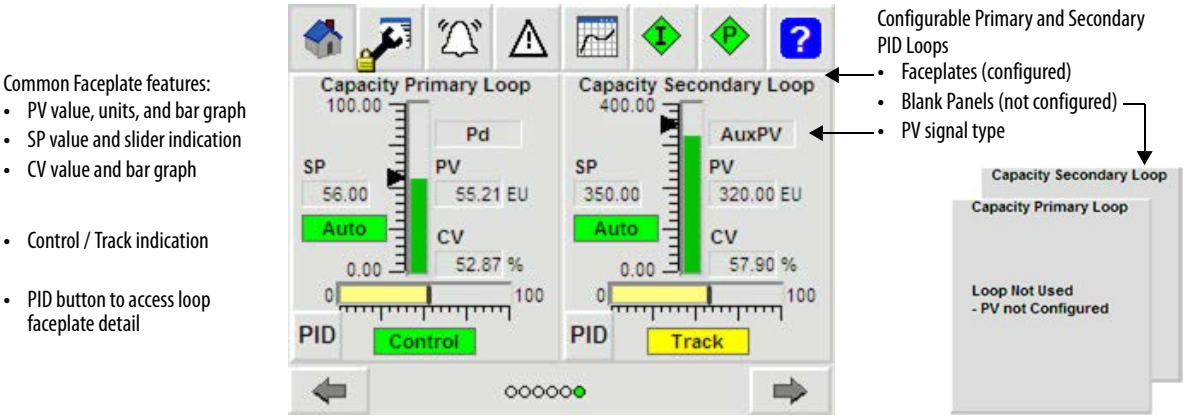


Capacity Control PID Loops Overview

Capacity control is provided through two optional PID loops, each configurable for the choice of process variable to control. Typically one PV would be the primary control measure, and a secondary control measure might be considered for an override controller. For instance, the primary capacity control measure may be discharge pressure (for example, Pd on AIN channel 2). A secondary override control may be required to limit power or amps on an electric motor driving the compressor. The auxiliary control PV input (AIN channel 3) would be connected to this measurement.

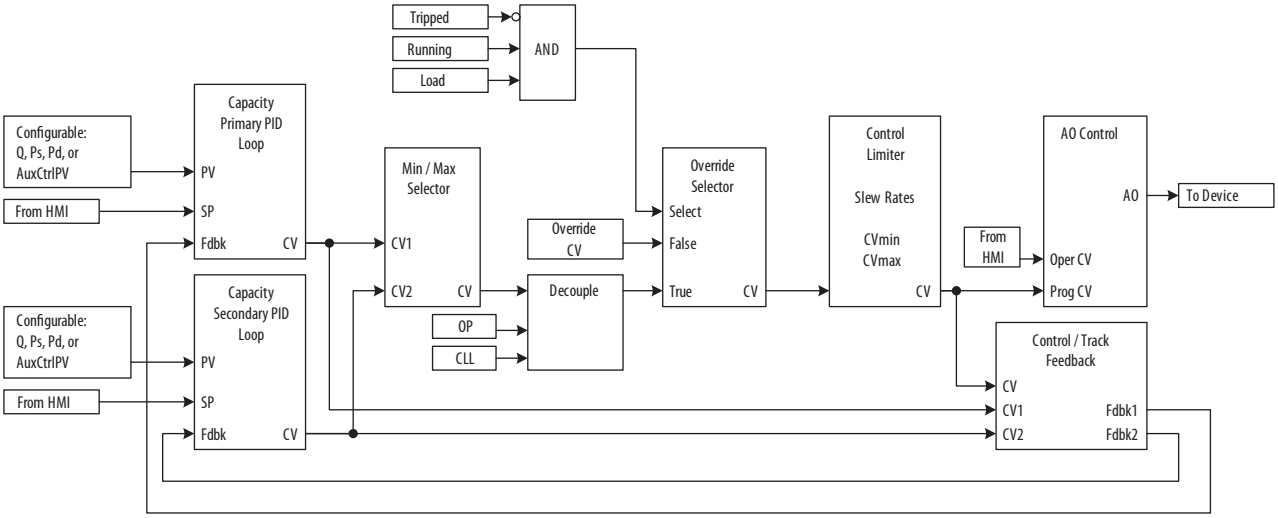
Page 6 of the Operator screen provides an overview of these two capacity control PID loops.

Figure 22 - Operator Screen Page 6 Example



There are no direct operation features on this page. To operate or tune the loops, use the PID button PID to open the individual PID loop faceplate. More details on the PID faceplate are provided later in this chapter.

These two PID loop are managed together through a min/max selector, decoupler, control override selector, and a control limiter to create a final control value for the capacity control valve/device. These control features are illustrated in the following function diagram.



Checking Interlocks, Permissives, and Warnings

Interlocks and permissives should be cleared prior to a compressor startup. An interlock is a condition that needs to be normal or healthy in order to operate; while a permissive is a condition that needs to be healthy for the Ready-to-Start condition, but once the compressor is running the healthy condition can be lost without affecting the system.

A warning brings attention to an item that may prevent operation or reflect disabled/bypassed functionality of the unit.

Before attempting to start the compressor, the operator should check and understand all interlock, permissive and warnings present for the unit.

Interlocks

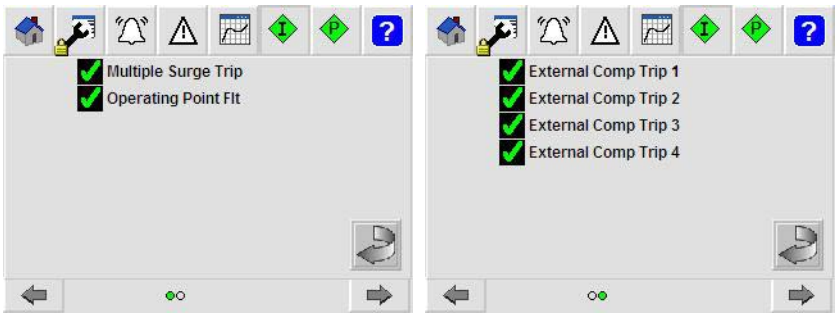
The overall unit interlock status is presented on the Interlock icon (third from the right) displayed on the navigation toolbar of any main screen.

The five icon status indications for interlocks are described in this table.

Interlock Icon	Interlock Status	Compressor Trip Output State
	All interlocks are healthy. Bypass is not enabled (no yellow caution symbol)	Normal – Healthy
	Interlocks status is unhealthy. Bypass is not enabled (no yellow caution symbol)	Tripped
	All interlocks are healthy. Bypass is enabled (yellow caution symbol)	Normal – Healthy
	All non-bypassed interlocks are healthy One or more bypassed interlocks are unhealthy Bypass is enabled (yellow caution symbol)	Normal – Healthy
	Interlock status is unhealthy Bypass is enabled (yellow caution symbol)	Tripped

To check the status of the individual interlocks, press on the toolbar to open the Interlock screen.

Figure 23 - Interlock Screen, Both Pages – All Healthy



The Interlock screen has two pages. Use the screen navigation arrow keys at the bottom to navigate between the two pages.

On the Interlock screen, each interlock has a visual status indication to identify whether the interlock is Normal/Tripped, Bypassed, or First-Out. This table explains these visual indications.

Visual Indication Example	Explanation
	The green check mark indicates the interlock status is normal-healthy.
	The red "X" indicates the interlock has tripped and latched. The interlock was not the first-out interlock. Once tripped, this indication remains until an interlock reset.
	The red "X" indicates the interlock has tripped and latched. The yellow highlight indicates the interlock is the first-out. Once tripped, this indication remains until an interlock reset.
	The yellow highlight indicates the interlock was first-out. The check mark indicates the interlock status is normal after the interlock reset was performed. The yellow highlight remains until all interlocks are normal and reset.
	The grey appearance indicates the interlock is bypassed. The check mark indicates the interlock status is normal.
	The grey appearance indicates the interlock is bypassed. The "X" indicates the interlock status is tripped.

Table 65 provides an explanation of each interlock.

Table 65 - Description of Interlocks

Interlock	Explanation
Multiple Surge Trip	A number of surges have occurred within a defined period of time. It would be unsafe to continue operation of the compressor. The reason for the surges should be investigated.
Operating Point Fault	The calculation for the compressor operating point (OP) has faulted. This may be due to invalid configuration, or failed transmitters that are necessary to determine the operating point.
External Comp Trip 1	The external compressor trip signal on the associated DIN channel has tripped.
External Comp Trip 2	The external compressor trip signal on the associated DIN channel has tripped.
External Comp Trip 3	The external compressor trip signal on the associated DIN channel has tripped.
External Comp Trip 4	The external compressor trip signal on the associated DIN channel has tripped.

Note: The name presented on the screen for each interlock is configurable. The default names are presented in the above table. You are encouraged to customize the names for the external interlocks to provide a more meaningful name presented for the interlock signal.

Latching Interlocks and Interlock Reset

The status indications for interlocks are latching. This traps any transitory interlocks that occurred on the system so they can be presented on the Interlocks screen.

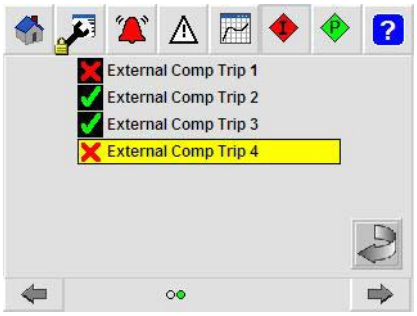
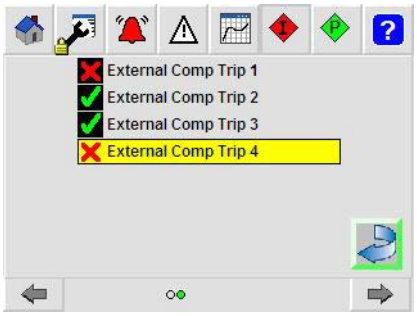
When a tripped interlock has returned to normal it must be reset by pressing the interlock reset button on either page of the Interlock screen.

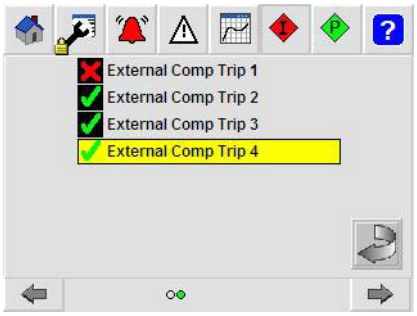
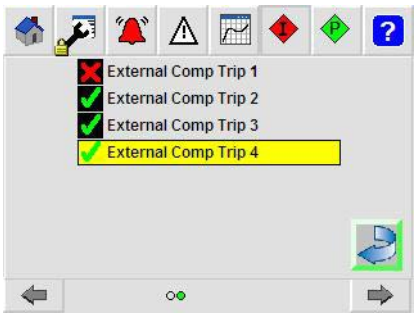
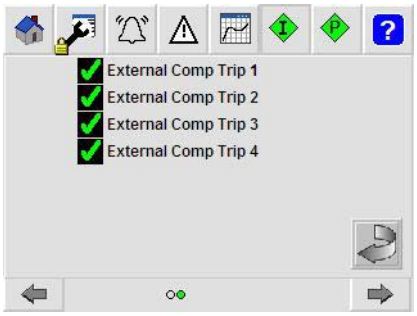
The availability to perform the interlock reset is represented by its appearance on the screen.

Button Appearance	Interlock Reset Availability
	Interlock reset action not available due to: • There are no tripped interlocks • All tripped interlock indications remain tripped (not returned to normal yet). • Security privilege is required.
	Interlock reset action is available: • Security privilege has been met (operator, supervisor, maintenance, engineer, or administrator). • One or more tripped interlocks has returned to normal.

Check and Reset an Interlock Example

The following sequence provides an example of how to check and reset interlocks.

Interlock Status Indications	Observations and Actions
	The Interlock icon status indicates tripped interlocks. Press the Interlock icon to open the Interlocks screen.
	On page 2 of the Interlocks screen, two of the external interlocks are shown tripped. • External Comp Trip 4 was first-out • External Comp Trip 1 also tripped. The appearance of the interlock Reset button indicates that reset is not available. • Assume that the operator is logged in. • The interlocks are still tripped.
	A while later, the interlock reset button is available, indicating one or more of the tripped interlocks can be reset. Press the interlock Reset button.

Interlock Status Indications	Observations and Actions
	After the interlock has been reset: • External Comp Trip 4 is normal (check mark). Yellow highlight still informs user that it was the first-out. • External Comp Trip 1 remains tripped (red X). The interlock Reset button is unavailable (waiting for External Comp Trip 1 to return to normal).
	A while later, the interlock Reset button is available, indicating that the remaining tripped interlock can be reset. Press the interlock Reset button.
	All interlocks are normal. The unit level interlock status indication on the toolbar is normal. The interlock Reset button is dimmed (there are no tripped interlocks remaining).

Permissives

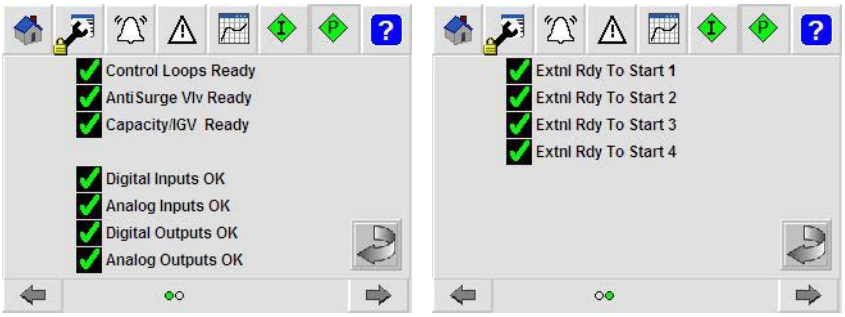
The overall unit permissive status is presented on the Permissives icon (second from the right) displayed on the navigation toolbar of any main screen.

The five icon status indications for permissives are described in this table.

Permissive Icon	Explanation of Interlock Status	Compressor Ready-To-Start Output
	All permissives healthy. Bypass is not enabled (no yellow caution symbol)	Ready
	Permissives status is unhealthy. Bypass is not enabled (no yellow caution symbol)	Not Ready
	All permissives are healthy. Bypass is enabled (yellow caution symbol)	Ready
	All non-bypassed permissives are healthy One or more bypassed permissives are unhealthy Bypass is enabled (yellow caution symbol)	Ready
	Permissives status is unhealthy Bypass is enabled (yellow caution symbol)	Not Ready

To check the status of the individual permissives, press the Permissive icon on the navigation toolbar to open the Permissive screen.

Figure 24 - Permissive Screen, Pages 1 and 2 – All Healthy



The Permissives screen has two pages. Use the screen navigation arrow keys at the bottom to navigate between the two pages.

On the Permissives screen, each permissive has a visual status indication to identify whether the permissive is Ready/Not-Ready, Bypassed, or First-Out. This table explains these visual indications.

Visual Indication Example	Explanation
	The green check mark indicates that the permissive status is Ready.
	The red "X" indicates the permissive is Not Ready. The permissive was not the First-Out permissive.
	The red "X" indicates the permissive is Not Ready. The yellow highlight indicates the permissive is the First-Out.
	The yellow highlight indicates the permissive was First-Out. The check mark indicates the permissive status has returned to Ready. The yellow highlight remains until all permissives have returned to Ready.
	The grey appearance indicates the permissive is Bypassed. The check mark indicates the permissive status is Ready.
	The grey appearance indicates the permissive is Bypassed. The "X" indicates the permissive status is Not Ready.

Table 66 provides an explanation of each permissive.

Table 66 - Description of Permissives

Permissive	Explanation
Control Loops Ready	Ready when all the PID loops configured for use are in the Auto mode.
AntiSurge Vlv Ready	Ready when the anti-surge control value and position feedback signals are within position deviation limits. If anti-surge position feedback signal is not configured, this permissive is always Ready.
Capacity/IGV Ready	Ready when the capacity control value and position feedback signals are within position deviation limits. If capacity control feedback signal is not configured, this permissive is always Ready.
Digital Inputs OK	Ready when the digital input module slot is healthy.
Analog Inputs OK	Ready when analog input module slot is healthy and all configured AIN channels are within range limits (no under-range or over-range conditions).
Digital Outputs OK	Ready when all digital output channels are in Program mode and the digital output module slot is healthy.
Analog Outputs OK	Ready when all analog output channels are in Program mode and the analog output module slot is healthy.
External Ready To Start 1	Ready when the associated external DIN signal is in the Ready state. If the DIN is not configured for use, the status is always Ready.
External Ready To Start 2	Ready when the associated external DIN signal is in the Ready state. If the DIN is not configured for use, the status is always Ready.
External Ready To Start 3	Ready when the associated external DIN signal is in the Ready state. If the DIN is not configured for use, the status is always Ready.
External Ready To Start 4	Ready when the associated external DIN signal is in the Ready state. If the DIN is not configured for use, the status is always Ready.

Note: The name presented on the screen for each permissive is configurable. The default names are presented in the above table. You are encouraged to customize the names for the external Ready-To-Start permissives to provide a more meaningful name presented for the permissive signal.

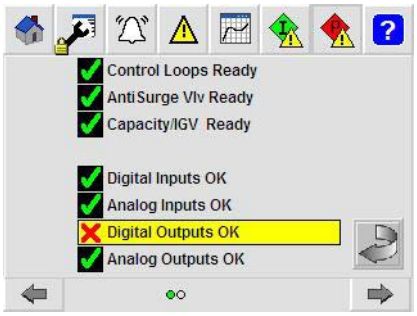
Permissive Reset

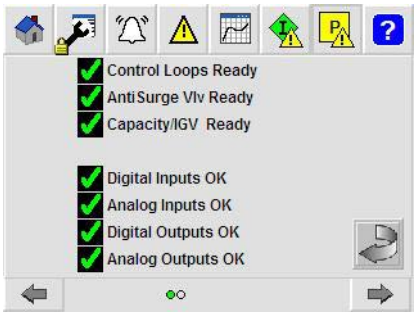
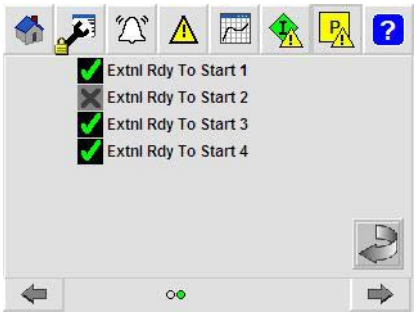
The status indications for permissive are non-latching. The Ready status (green check-mark) and Not-Ready status (red X) automatically update to show the present condition of the permissive.

Since the permissives do not latch, it is not necessary to use the permissive Reset button on the Permissive screen.

Check and Reset a Permissive Example

The following sequence provides an example of checking permissive indications.

Permissive status Indications	Observations and Actions
	The unit permissive status on the navigation toolbar informs the user that: • Permissives are not-ready (red diamond) • Bypass is enabled (yellow caution triangle) Press the Permissive Icon to open the Permissives screen.
	On page 1 of the Permissives screen: Digital outputs OK is not ready. This could be because: • A digital output is not in Program mode • The digital output module slot is not healthy
	Investigating the digital outputs revealed a digital output channel was in Operator mode. The channel was returned to Program mode. As a result, the unit permissive status on the navigation toolbar now indicates: • All non-bypassed permissives OK (yellow square).

Permissive status Indications	Observations and Actions
	Re-examining the permissives status: On page 1, all permissives are ready.
	On page 2, the external ready to start 2 permissive is not ready, but the dimmed appearance indicates the signal is bypassed. Because it is bypassed, this permissive is not required to be ready. The compressor ready-to-start output signal is ready.

Warnings

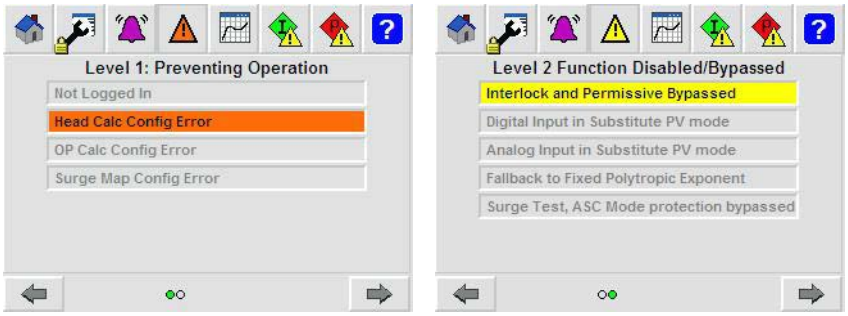
The overall unit warnings status is presented on the Warnings button (fourth from the left) displayed on the navigation toolbar of any main screen.

The three icon status indications for warnings are described in this table.

Warnings Icon	Explanation of Warning status	Recommended Action
	No warnings present	None Required
	Level 1: Preventing operation	Check Warning screen, page 1
	Level 2: Function disabled or bypassed	Check Warning screen, page 2

To check the status of the individual warnings, press the Warnings button on the navigation toolbar to open the Warnings screen.

Figure 25 - Warnings Screens – Examples


Level 1: Preventing Operation
Not Logged In
Head Calc Config Error
OP Calc Config Error
Surge Map Config Error
Level 2 Function Disabled/Bypassed
Interlock and Permissive Bypassed
Digital Input in Substitute PV mode
Analog Input in Substitute PV mode
Fallback to Fixed Polytropic Exponent
Surge Test, ASC Mode protection bypassed

The Warnings screen has two pages. Use the screen navigation arrow keys at the bottom to navigate between the two pages.

On the Warnings screen, each warning has a visual status indication. This table explains these visual indications.

Warning – Visual Indication Example	Explanation
Surge Test, ASC Mode protection bypassed	Normal, no warning condition (no color indication)
Not Logged In	Level 1 warning condition exists (orange color)
Analog Input in Substitute PV mode	Level 2 warning condition exists (yellow color)

Table 67 provides an explanation of each warning.

Table 67 - Descriptions of Warnings

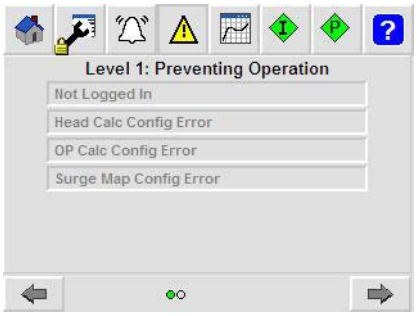
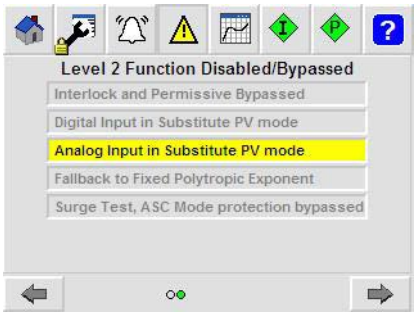
Warning	Explanation
Not Logged In	Default user - No security privileges. Log into HMI to obtain desired level of access.
Head Calc Config Error	Configuration parameters required for compressor head calculation are invalid. Check relevant configuration settings and correct as required.
OP Calc Config Error	Configuration parameters required for compressor operating point calculation are invalid. Check relevant configuration settings and correct as required.
Surge Map Config Error	Configuration parameters required for compressor surge map are invalid. Check relevant configuration settings and correct as required.
Interlock and Permissive Bypassed	Bypasses are enabled for interlocks and permissives. Check interlocks and permissives to familiarize which functions may be bypassed.
Digital Input in Substitute PV mode	One or more digital input channels in substitute PV mode. System will not respond to the relevant field input device(s).

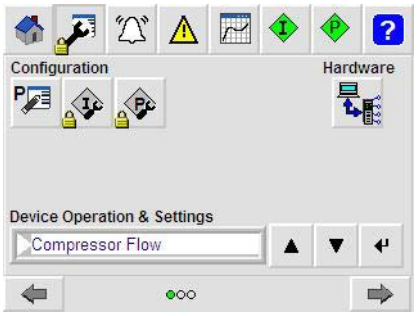
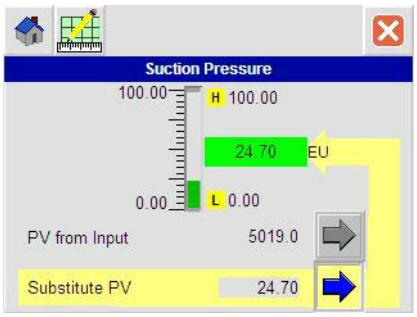
Table 67 - Descriptions of Warnings (Continued)

Warning	Explanation
Analog Input in Substitute PV mode	One or more analog input channels in substitute PV mode. System will not respond to actual field transmitter signal(s).
Fallback to fixed polytropic exponent	A failed transmitter exists which prevents the system from calculating a polytropic exponent from actual pressure and temperature measurements. A fixed polytropic exponent calculation is used f(k, Peff). This may affect the accuracy of the head calculation.
Surge Test: ASC mode protection bypassed	Surge test is enabled, bypassing the normal protection limits for Manual mode operation of the anti-surge primary PID loop. In this condition, it is possible to drive the compressor into surge by operating the ASC primary PID loop in Manual mode.

Check and Reset a Warning Example

The following sequence provides an example of checking warning indications.

Screen Indications	Observations and Actions
	The unit warning status on the navigation toolbar informs the user that: - Warnings are present (yellow) Press the Warnings icon to open the Warnings screen.
 	Page 1: Preventing Operation - No warnings Page 2: Function Disabled/ Bypassed - warning Analog input in Substitute mode indicates that one or more of the configured analog input channels is using a substitute PV, bypassing the actual input PV from the transmitter.

Screen Indications	Observations and Actions
	Navigation to the Maintenance/Configuration Screen Using the Device Operation & Settings selector field to browse the analog input devices: Compressor Flow Suction Pressure Discharge Pressure Auxiliary Control Signal Suction Temperature Discharge Temperature Multi-Use Signal A MultiUse Signal B
	Through browsing the analog input devices, it is observed that the suction pressure input is in Substitute PV mode. Check with operations and maintenance to identify if it is safe to operate the unit in this condition.

Compressor Start and Stop

The SSCC is primarily responsible for anti-surge and capacity control for the compressor. Typically another controller or interlock system is used to start and stop the drive (motor, turbine, etc.) that turns the compressor.

The SSCC provides interface I/O to coordinate the following signals with the drive controller.

- Ready-to-start digital output signal to the drive controller. This signal is controlled based on the unit permissive status.
- Compressor trip digital output signal to the drive controller. This signal is controlled based on the unit interlock status.
- Compressor running digital input signal from the drive controller.

The compressor state of operation is influenced by the interlocks (trip), permissives (ready-to-start), running determination, and load/unload requests.

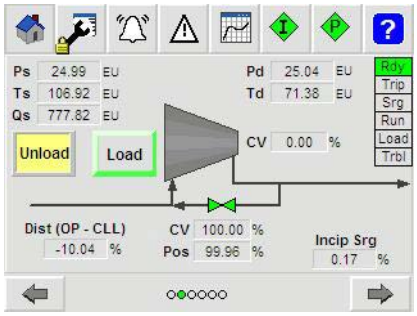
It is highly recommended that alarms or warnings be cleared before starting the compressor. The toolbar icons for alarm and warning should be white indicating that none of these categories has active items.

ATTENTION: Do not attempt to start the compressor if the unit's configuration has not been completed. All relevant configuration parameters discussed in this chapter must be properly configured. Failure to do so may cause equipment damage or personal injury.

ATTENTION: Visual confirmation of the anti-surge valve position and capacity valve position is recommended before starting the compressor. Failure to do so may cause equipment damage or personal injury.

When the compressor is ready to start, the Compressor Overview screen should appear as shown in Figure 26.

Figure 26 - Compressor Overview – Ready to Start



The following key indications are present when the compressor is ready to start.

Indication	Description
Alarm Status	Alarms clear If alarms are present, they have been checked, understood, and operations ready to proceed.
Warning Status	No warnings If warnings are present, they have been checked, understood, and operations ready to proceed.
Interlock Status	Interlocks OK, or all non-bypassed OK. Trip Compressor trip output, Not-Tripped
Permissive Status	Permissives – Ready, or all non-bypassed – Ready Rdy Ready-to-Start output, Ready
ASC Valve	Anti-surge valve CV at pre-start override value.
Capacity Valve/Device (if configured)	Capacity valve/device CV at pre-start override value.

Compressor Running Determination

Compressor running condition is determined by one or more of the following conditions.

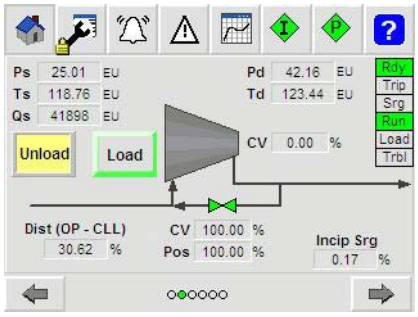
- Compressor running digital input status
- Compressor head calculation > threshold
- Auxiliary control signal > threshold

When one of the above conditions is met for the configured on-delay time, then a confirmed compressor running status is determined.

These specific running determination methods are configured in 14: Run and Load Configuration on page 68.

The confirmed compressor running status is annunciated on the Compressor Overview - Operator (page 2) screen. In addition to this HMI annunciation, the compressor running digital output (DOUT channel 4) is energized for external indication/usage.

Figure 27 - Compressor Overview – Running Status



Once reaching the running state the compressor is ready for loading.

Compressor Load/Unload

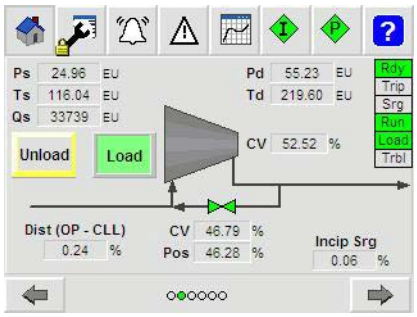
After the compressor running condition is established and there are no compressor trip conditions, the compressor is available to load. Loading the compressor can be accomplished in one of the following ways, based on configured options.

- Auto-load on confirmed run - Load is automatically triggered after the confirmed running condition described previously.
- Load push-button - Digital input channel 2 may be wired to an external push button to manually request compressor load.
- Load button on HMI - Load button on Compressor Overview - Operator screen is pressed to manually request compressor load.

The confirmed compressor load status is annunciated on the Compressor Overview - Operator screen (page 2). In addition to this HMI annunciation, the compressor loaded digital output (DOUT channel 5) is energized for external indication/usage.

Once the compressor is set to load, the anti-surge and capacity valve/devices are released from their respective override values, and available for regulatory control by the configured anti-surge and capacity control PID functions.

Figure 28 - Compressor Overview – Compressor Loaded Status



The Operator screens and PID faceplates can now be used to control and adjust the operating behavior of the compressor.

Device Faceplates

The HMI provides several device faceplates to operate and configure devices. The following tables provide an overview of these device faceplates and their features.

Table 68 - Analog Input Device Faceplate

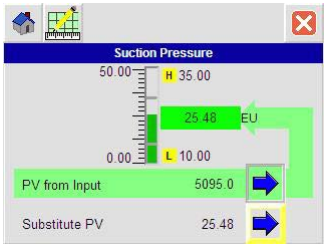
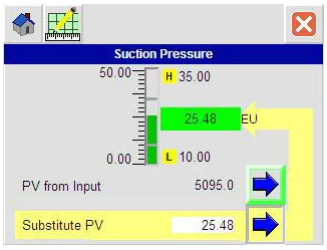
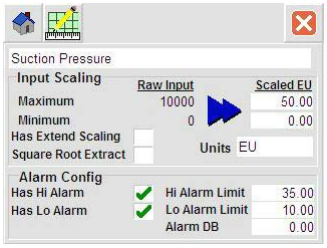
Tab	Sample Screen	Description
	 **Input PV Mode**  **Substitute PV Mode**	Analog Input Device Faceplate – Operator tab Display Features: • Banner with device name • Bar graph display of PV value in use • High and low alarm value setpoint values, and level indicators on bar graph • Indicators for Over-range, Under-range, IO Fault, and Channel Not Configured For Use when conditions are present • Visual indication of Input PV or Substitute PV modes Operational Features: • Use Mode select buttons to choose between PV from input, or Substitute PV mode - security privilege required (M, E, or A). • In Substitute PV mode, enter the substitute PV value - security privilege required (M, E, or A).
		Analog Input Device Faceplate – Configuration tab Display Features: • Configuration parameter values viewable regardless of security privilege Configuration Features: • Customize the device name, and unit of measure strings - security privilege required (E or A). • Configure engineering unit scaling - security privilege required (E or A). • Configure alarm settings - security privilege required (E or A)

Table 69 - Analog Output Device Faceplate

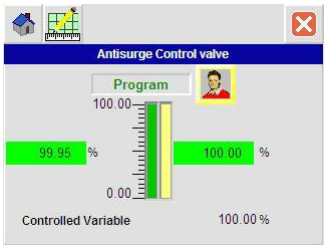
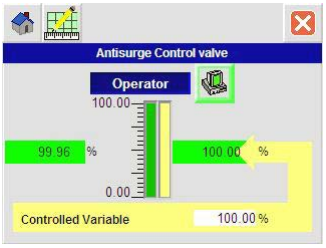
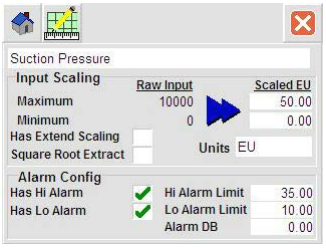
Tab	Sample Screen	Description
	 **Program Mode**  **Operator Mode**	Analog Output Device Faceplate – Operator tab Display Features: • Banner with device name • Bar graph display of CV value in use • Valve position feedback value (when configured) • Indicator for IO Fault when condition present • Visual indication of Program or Operator modes Operational Features: • Use and to choose between Program and Operator mode - security privilege required (O, S, M, or E). • In Operator mode, enter the manual CV value - security privilege required (O, S, M, or E).
		Analog Output Device Faceplate – Configuration tab Display Features: • Configuration parameter values viewable regardless of security privilege Configuration Features: • Customize the device name, and unit of measure strings - security privilege required (E or A). • Other configurable properties for reference only. Some available from compressor details device faceplate.

Table 70 - Digital Input Device Faceplate

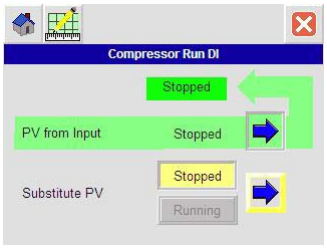
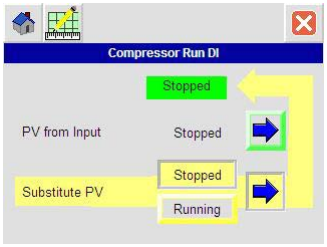
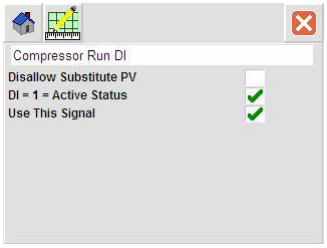
Tab	Sample Screen	Description
	 **Input PV Mode**  **Substitute PV Mode**	Digital Input Device Faceplate – Operator tab Display Features: • Banner with device name • Device state represented with descriptive word • Indicators for IO Fault, and Channel Not Configured For Use when conditions present • Visual indication of Input PV or Substitute PV modes Operational Features: • Use to choose between PV from Input, or Substitute PV mode - security privilege required (M, E, or A). • In Substitute PV mode, use state buttons to set substitute PV state - security privilege required (M, E, or A).
		Digital Input Device Faceplate – Configuration tab Display Features: • Configuration parameter values viewable regardless of security privilege Configuration Features: • Customize the device name - security privilege required (E or A). • Configure channel usage, active state, and use of Substitute PV mode - security privilege required (E or A).

Table 71 - Digital Output Device Faceplate

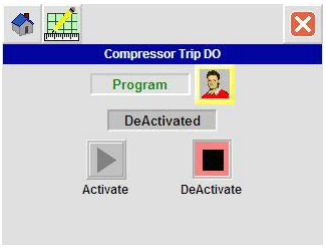
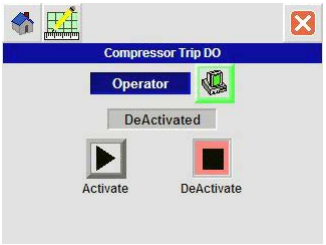
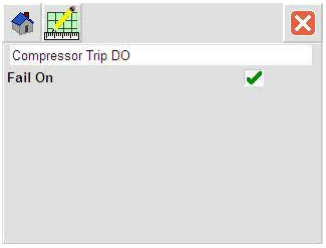
Tab	Sample Screen	Description
	 **Program Mode**  **Operator Mode**	Digital Output Device Faceplate – Operator tab Display Features: • Banner with device name • Indication of device state; Activated or Deactivated • Indicator for IO Fault when condition present • Visual indication of Program or Operator modes Operational Features: • Use and to choose between Program and Operator mode - security privilege required (O, S, M or E). • In Operator mode, use and to set output value - security privilege required (O, S, M or E).
		Digital Output Device Faceplate – Configuration tab Display Features: • Configuration parameter values viewable regardless of security privilege Configuration Features: • Customize the device name - security privilege required (E or A). • Configure device operation/fail state.

Table 72 - PID Loop Faceplate

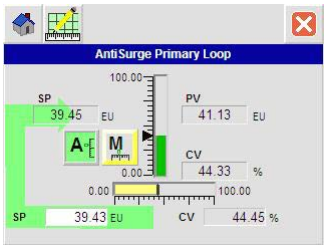
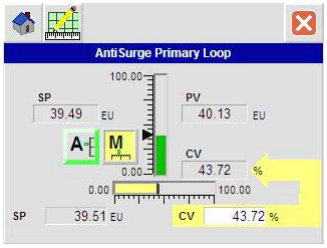
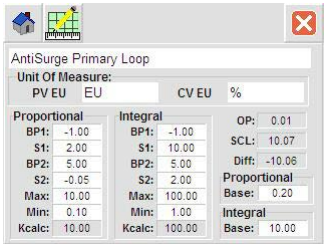
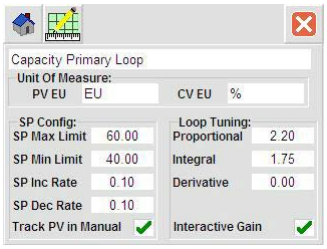
Tab	Sample Screen	Description
	 **Auto Mode**  **Manual Mode**	PID Loop Faceplate – Operator tab Display Features: • Banner with loop name • Indication of Loop mode • Values for SP, PV, CV • Vertical bar graph of PV with setpoint slider • Horizontal bar graph of CV • Visual indication of Program or Operator modes Operational Features: • Use to choose between Auto and Manual mode - security privilege required (O, S, M, or E). • In Auto mode, use SP value entry - security privilege required (O, S, M, or E). • In Manual mode, use CV value entry - security privilege required (O, S, M, or E).
	 **Anti-Surge Primary PID Loop**  **Other PID Loops**	PID Loop Faceplate – Configuration/Tuning tab Display Features: • Configuration parameter values viewable regardless of security privilege Configuration Features: • Customize the loop name and units for PV and CV - security privilege required (E or A). • Adaptive tuning parameters (ASC primary PID loop) • Standard tuning parameters (other PID loops) • Setpoint configuration parameters (other PID loops)

Table 73 - Compressor Details Faceplate

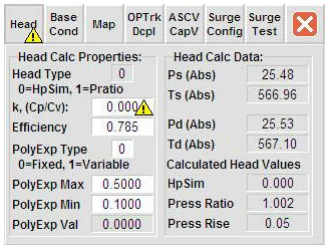
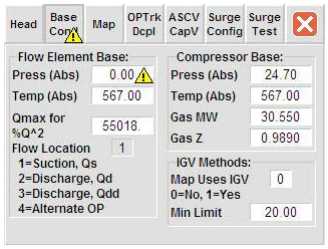
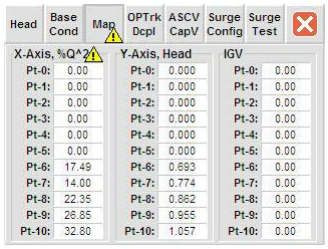
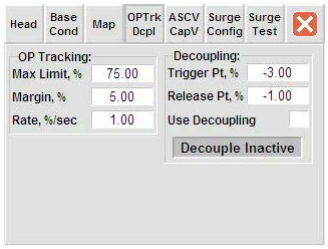
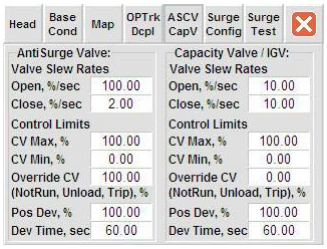
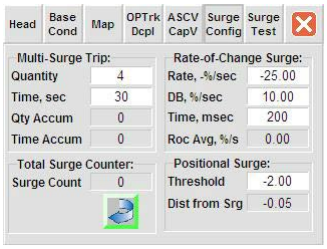
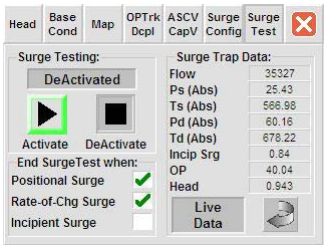
Tab	Sample Screen	Description
Head		Compressor Details Faceplate – Head tab Configuration Features: • Head calculation properties - security privilege required (E or A). • Pressures and temperatures in absolute units. • Head calculation values . • Head calc configuration error indications ⚠ if present.
Base Cond		Compressor Details Faceplate – Base Conditions tab Configuration Features: • Flow element location type. • Flow element configuration (base press and temp, max flow for normalization) - security privilege required (E or A). • Compressor base configuration (base press and temp, gas properties) - security privilege required (E or A). • IGV method configuration - security privilege required (E or A). • OP calc configuration error indications ⚠ if present.
Map		Compressor Details Faceplate – Map tab Configuration Features: • Compressor map surge limit line configuration - security privilege required (E or A). • Map configuration error indications ⚠ if present.
OPTrk Dcpl		Compressor Details Faceplate – OP Tracking / Decoupling tab Configuration Features: • OP tracking tuning properties - security privilege required (M, E, or A). • Decoupling tuning properties - security privilege required (M, E, or A). • Use decoupling configuration property - security privilege required (E or A). • Decoupling status.

Table 73 - Compressor Details Faceplate (Continued)

Tab	Sample Screen	Description
ASCV CapV		Compressor Details Faceplate – Anti-Surge / Capacity Valve tab Configuration Features: • Anti-surge valve configuration properties (slew rates, control limits, position deviation alarm settings) - security privilege required (M, E, or A). • Capacity calve / IGV configuration properties (slew rates, control limits, position deviation alarm settings) - security privilege required (M, E, or A).
Surge Config		Compressor Details Faceplate – Surge Configuration tab Configuration Features: • Multi-surge trip configuration properties - security privilege required (E or A). • Rate-of-change and positional surge properties - security privilege required (M, E, or A). Operational Features: • Press the reset button to reset the compressor surge counter - security privilege required (E, or A).
Surge Test		Compressor Details Faceplate – Surge Test tab Display Features: • Surge testing status and configuration. • Live/Trapped operational data from surge test. Operational Features: • Activate and Deactivate surge test buttons - security privilege required (E, or A). • Choose from positional, rate-of-change, and incipient surge methods for surge test capture - security privilege required (E or A). • Press to reset surge test data - security privilege required (E or A).

Accessing Device Faceplates

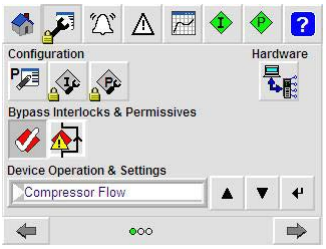
The device faceplates provide graphical detail of both operational and configurable features for a particular I/O device, PID loop, or the compressor details.

To access the faceplates within the HMI, follow these steps to navigate to the Maintenance screen, and successfully open the faceplate of choice.

1. Press to close any open pop-up screens and return to a main screen showing the navigation toolbar.
2. Press on the navigation toolbar.

   The Maintenance screen appears.

3. Press → to page forward, or ← to page backward, as required to navigate to page one of the Maintenance screen (shown here).



4. Press ▲ ▼ to select the device you want to access in the Device Operation & Settings selector list at the bottom of the screen.

5. Press ↵ to open the selected device faceplate.

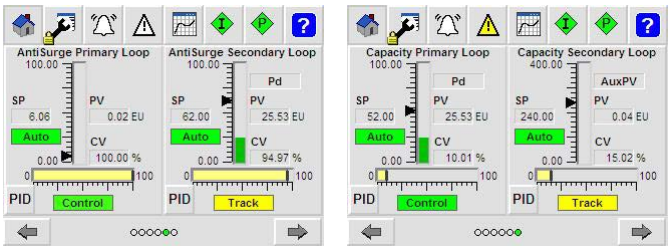
Accessing the PID Faceplates from the Operator Screen

For convenience, the PID faceplates and the compressor details faceplate can be accessed from certain Operator screens. Follow these steps to access the PID faceplates.

1. Press ✕ to close any open pop-up screens and return to a main screen showing the navigation toolbar.

2. Press ⌂ on the main navigation toolbar to navigate to the Operator screen.

3. Press → to page forward, or ← to page backward, as required to navigate to the Operator screen, Anti-Surge PID Overview (page 5), or the Capacity PID Overview screen (page 6), shown here.



Note, only those PID loops that are configured will be shown on these screens.

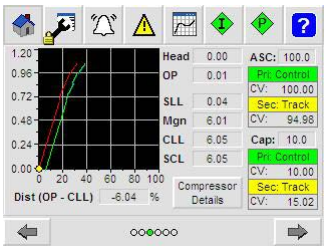
4. Press PID to open the desired PID faceplate.

Accessing the Compressor Details Faceplates from the Operator Screen

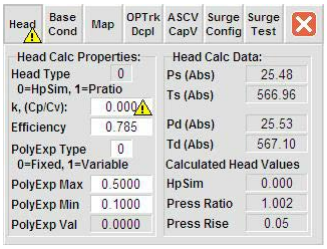
1. Press to close any open pop-up screens and return to a main screen showing the navigation toolbar.

2. Press on the main navigation toolbar to navigate to the Operator screen.

3. Press to page forward, or to page backward, as required to navigate to the Operator screen - Compressor Map Overview (page 3), shown here.



4. Press to open the Compressor Details faceplate.



Device Names and Device Selector

The Device Operation & Settings (device) selector on the Maintenance screen presents the devices by the device name. From the device faceplates the names can be customized, and even made blank. If after customization the device names are changed and it becomes difficult to identify the devices presented in the device selector, the following list can be helpful to re-orient and identify the devices.

The device selector presents the devices in a pre-determined order. The order and default names for each device are shown in Table 74 on page 131.

Each time you navigate to the Maintenance screen from another main screen, the device order resets to the start of the list at the device allocated for compressor flow.

Table 74 - Order of Devices on the Device Selector

Order	Device Name (default)	Description of Device
1	Compressor Flow	AIN channel 0, allocated for Compressor Flow
2	Suction Pressure	AIN channel 1, allocated for Suction Pressure
3	Discharge Pressure	AIN channel 2, allocated for Discharge Pressure
4	Auxiliary Control PV Signal	AIN channel 3, allocated for an additional process transmitter which can be used as a PV for control loops.
5	Suction Temperature	AIN channel 4, allocated for Suction Temperature
6	Discharge Temperature	AIN channel 5, allocated for Discharge Temperature
7	Multi-Signal A	AIN channel 6, configurable usage
8	Multi-Signal B	AIN channel 7, configurable usage
9	Antisurge Control valve	AOUT channel 0, allocated for Anti-Surge Valve
10	Capacity Control valve	AOUT channel 1, allocated for Capacity control device
11	Compressor Run DI	DIN channel 0, allocated for Compressor Run input from the drive system
12	Reset Push Button	DIN channel 1, allocated for external Reset P.B.
13	Load Request Push Button	DIN channel 2, allocated for external Load P.B.
14	Unload Request Push Button	DIN channel 3, allocated for external Unload P.B.
15	External Ready To Start 1	DIN channel 8, allocated for Ready To Start 1, a Permissive
16	External Ready To Start 2	DIN channel 9, allocated for Ready To Start 2, a Permissive
17	External Ready To Start 3	DIN channel 10, allocated for Ready To Start 3, a Permissive
18	External Ready To Start 4	DIN channel 11, allocated for Ready To Start 4, a Permissive
19	External Compressor Trip 1	DIN channel 12, allocated for Compressor Trip 1, an Interlock
20	External Compressor Trip 2	DIN channel 13, allocated for Compressor Trip 2, an Interlock
21	External Compressor Trip 3	DIN channel 14, allocated for Compressor Trip 3, an Interlock
22	External Compressor Trip 4	DIN channel 15, allocated for Compressor Trip 4, an Interlock
23	Compressor Trip DO	DOUT channel 0, allocated for Compressor Trip Interlock signal to the drive controller.
24	Surge Alarm	DOUT channel 1, allocated for optional Surge Alarm status indication
25	System Trouble	DOUT channel 2, allocated for optional System Trouble status indication
26	Ready To Start DO	DOUT channel 3, allocated for Ready To Start Permissive signal to the drive controller
27	Compressor Running DO	DOUT channel 4, allocated for optional Compressor Running status indication
28	Compressor Loaded	DOUT channel 5, allocated for optional Compressor Loaded status indication
29	AntiSurge Primary Loop	Anti-Surge Primary PID Loop, allocated to pre-configured algorithm to control Operating Point (OP) as PV relative to Surge Control Line (SCL) as the SP. Controls the Anti-Surge valve.
30	AntiSurge Secondary Loop	Optional Anti-Surge Secondary PID Loop. Configurable PV choice. Used as over-ride PID in a Max select arrangement with the Anti-Surge Primary PID Loop.
31	Capacity Primary Loop	Optional Capacity Primary PID Loop. Configurable PV choice. Controls the Capacity control valve / IGV.
32	Capacity Secondary Loop	Optional Capacity Secondary PID Loop. Configurable PV choice. Use as over-ride PID in a Min/Max select arrangement with the Capacity Primary PID Loop.
33	Compressor Details	Compressor configuration and information details popup.

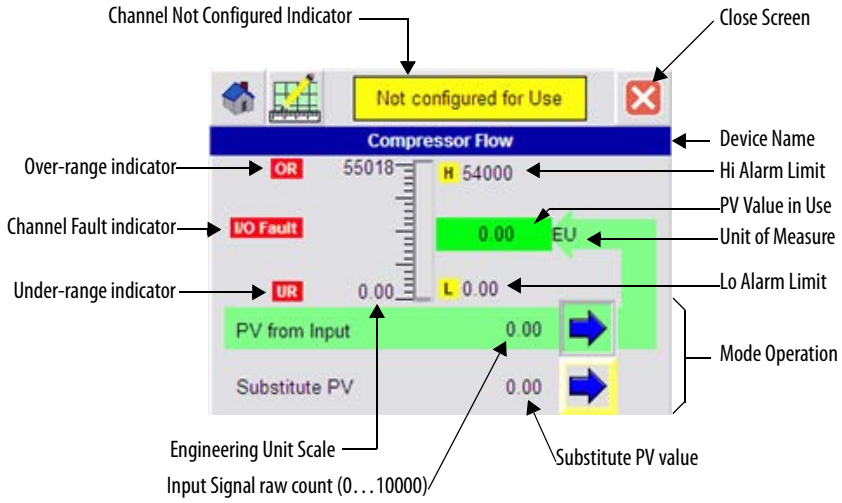
Analog Input Device Faceplate

The Analog Input Device faceplate provides a graphical interface to the operational and configurable behaviors of the analog input channels.

Analog Input Device Operation

Press to display the Operations page. The following illustration details the features of the Device Operation page.

Figure 29 - Analog Input Faceplate – Operations Page



The analog input device supports two modes of operation: 1) PV from Input, and 2) Substitute PV.

Under normal operations, the mode should be PV from Input. This mode uses the measured input signal raw count (0...10000), and converts it to engineering units according to the configured scaling settings. The scaled value is presented as the process value (PV) in use.

Substitute PV mode lets you to override the measured value, and substitute in its place, a desired engineering unit value. This mode may be useful should a transmitter fail, require maintenance, or calibration. Use of Substitute PV mode produces a warning.

Through configuration (refer to parameter list 24: AINs - Substitute PV) the use of Substitute PV mode can be disallowed. When disallowed, the Substitute PV features are absent from the device operation graphic and the device mode will be PV from Input.

The mode operation buttons and Substitute PV value entry require security privileges (maintenance, engineer, or administrator).

When the device is in PV from Input mode, the Substitute PV value automatically tracks the scaled PV value. This makes the transition to Substitute PV mode bumpless.

Analog Input Device Configuration

Press to display the Configuration page. Many of the analog input channel configuration parameters may be adjusted on this page.

Figure 30 - Analog Input Faceplate – Configuration Page

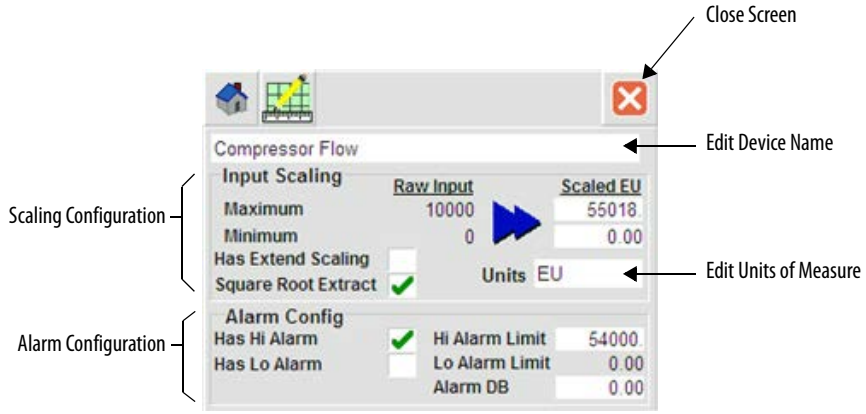


Table 75 lists the configuration items displayed on the Analog Input Faceplate - Configuration page and the corresponding parameter used for configuration. The parameters listed in the table are contained in the 01: AIN - Compressor Flow parameter list.

Table 75 - Analog Input Faceplate to Parameter Cross Reference

Faceplate Configuration Item	Configuration Parameter
Scaled EU - Maximum	02: Eng Unit Scale Max (EU)
Scaled EU - Minimum	03: Eng Unit Scale Min (EU)
Has Extend Scaling (check box)	05: Extrap Scaling (1=Yes)
Square Root Extract (check box)	04: Scaling (0=Linear, 1=Sqrt)
Has Hi Alarm (check box)	07: Has Alarm High (1=Yes)
Has Lo Alarm (check box)	08: Has Alarm Low (1=Yes)
Hi Alarm Limit (value)	09: High Alarm Limit (EU)
Lo Alarm Limit (value)	10: Low Alarm Limit (EU)
Alarm DB	11: Alarm Deadband (EU)

Customize the Channel

From the device configuration, you may edit the description, and the units of measure. These represent string tags in the HMI (not the controller). These tags are retentive and saved in the HMI memory. For example, you may want to include the device tag number in the description (for example: “FT-1007 Compressor Flow”), and set the units of measure (for example: “acfm”).

String Tag limits are:

Description: 34 characters

Unit of Measure: 6 characters

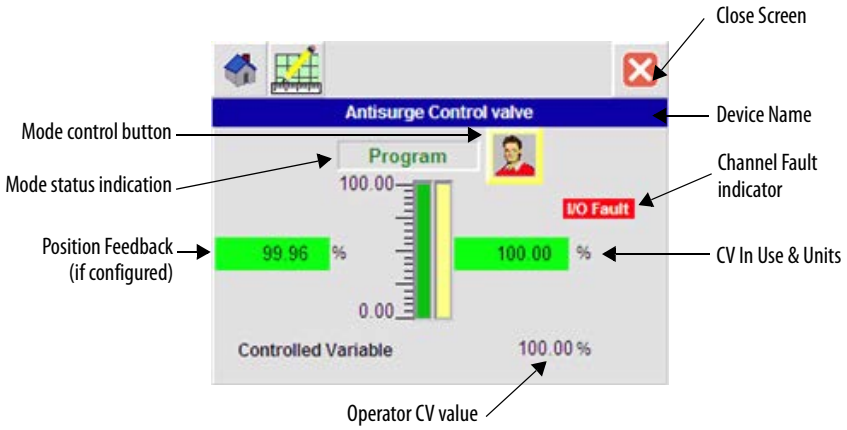
Analog Output Device Faceplate

The Analog Output Device faceplate provides a graphical interface to the operational and configurable behaviors of the analog output channels.

Analog Output Device Operation

Press to display the Operations page. The following illustration details the features of the Device Operation page.

Figure 31 - Analog Output Faceplate – Operations Page



The analog output device supports two modes of operation: 1) Program, and 2) Operator.

Under normal operations, the mode should be Program. In Program mode the application program and interlocks determine the control value (CV) in use. When the device is in Program mode, the operator CV value automatically tracks the CV value in use. This makes the transition to Operator mode bumpless.

Operator mode is intended only for device maintenance and testing when the compressor is not running. When in Operator mode, the operator CV value can be entered from the screen. Use of Operator mode sets the permissive, analog outputs OK, to Not-Ready.

When the compressor is running, the device mode is automatically set to Program mode, and the Mode control button is not available. When the compressor is not running, the mode control button is presented on the screen.

Current Mode	Mode Button	Button Action
Program	None	The compressor is running, mode change not available.
Program		Pressing the button switches the mode to Operator.
Operator		Pressing the button switches the mode to Program.

The mode operation buttons and operator CV value entry require security privileges (operator, supervisor, maintenance, or engineer).

Analog Output Device Configuration

Press to display the Configuration page. Configuration parameters relating to the valve devices can be observed on this page. Note, these configuration parameters are not changed on this page. See Table 76.

Figure 32 - Analog Output Faceplate – Configuration Page

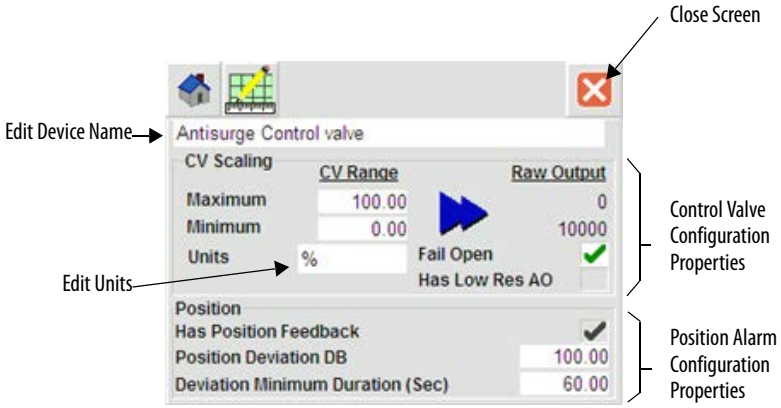


Table 76 lists the configuration items displayed on the Analog Output Faceplate - Configuration page and the corresponding parameter lists and parameter numbers used for configuration.

Table 76 - Analog Output Faceplate Configuration Parameter List Cross Reference

Faceplate Configuration Item	Parameter List / Parameter	
CV Range – Maximum	None, set in logic, 100.0% Open	
CV Range – Minimum	None, set in logic, 0.0% Open	
Fail Open (check box)	Anti-Surge Valve List: 15, Parameter: 10 Valve Fail: (0=Clsd,1-Opn)	Capacity Valve / IGV List: 20, Parameter: 09 Valve Fail: (0=Clsd,1-Opn)
Has Low Res AO (check box)	None, not used	
Has Position Feedback (check box)	None, set in logic based on Multi-Sig AIN usage for position feedback signals.	
Position Deviation DB	Anti-Surge Valve List: 15, Parameter: 11 Pos Dev Alm DB (%)	Capacity Valve / IGV List: 20, Parameter: 10 Pos Dev Alm DB (%)
Deviation Minimum Duration (Sec)	Anti-Surge Valve List: 15, Parameter: 12 Pos Dev Alm Time (sec)	Capacity Valve / IGV List: 20, Parameter: 11 Pos Dev Alm Time (sec)

Customize the Channel

From the device configuration, you may edit the description, and the units of measure. These represent string tags in the HMI (not the controller). These tags are retentive and saved in the HMI memory. For example, you may want to include the device tag number in the description (for example: “FCV-1007 AntiSurge Valve”), and set the units of measure (for example: “% Open”).

String Tag limits are:

Description: 34 characters

Unit of Measure: 6 characters

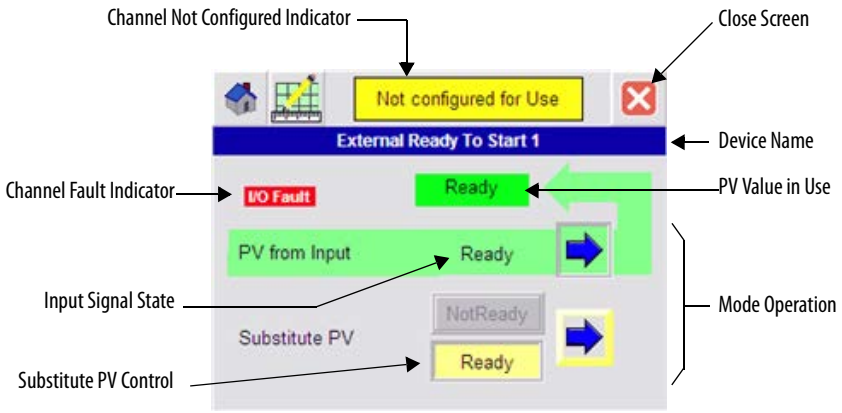
Digital Input Device Faceplate

The Digital Input Device faceplate provides a graphical interface to the operational and configurable behaviors of the digital input channels.

Digital Input Device Operation

Press to display the Operations page. The following illustration details the features of the Device Operation page.

Figure 33 - Digital Input Faceplate – Operations Page



The digital input device supports two modes of operation: 1) PV from Input, and 2) Substitute PV.

Under normal operations, the mode should be PV from Input. This mode uses the actual input signal applying the configured input state. The value is presented as the process value (PV) in use.

Substitute PV mode allows the user to override the input value, and substitute in its place, the desired value. This mode may be useful should a device fail, require maintenance, or troubleshooting. Use of Substitute PV mode produces a warning.

Through configuration (refer to parameter list 25: DINs - Substitute PV) the use of Substitute PV mode can be disallowed. When disallowed, the substitute PV features are absent from the device operation graphic and the device mode will be PV from Input.

The mode operation buttons and substitute PV value buttons require security privileges (maintenance, engineer, or administrator).

When the device is in PV from Input mode, the substitute PV value automatically tracks the scaled PV value. This makes the transition to Substitute PV mode bumpless.

Digital Input Device Configuration

Press to display the Configuration page. Many of the digital input channel configuration parameters may be adjusted on this page.

Figure 34 - Digital Input Faceplate – Configuration Page

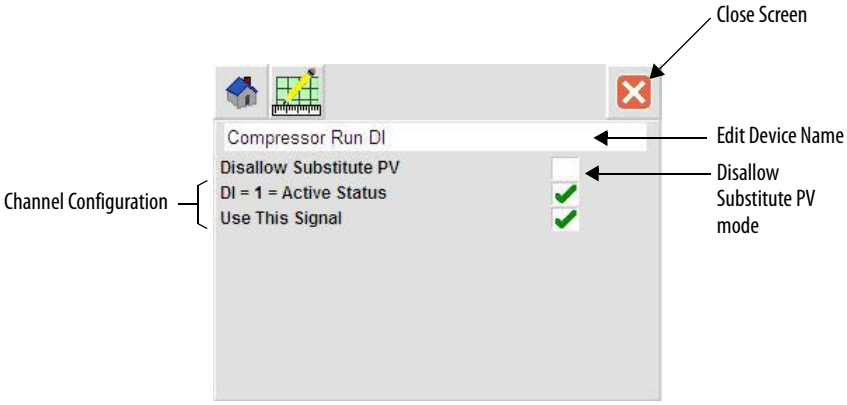


Table 77 lists the configuration items displayed on the Digital Input Faceplate - Configuration page and the corresponding parameter lists and parameter numbers used for configuration.

Table 77 - Digital Input Faceplate Configuration Parameter List Cross Reference

Faceplate Configuration Item	Parameter List / Parameter
Disallow Substitute PV	List: 25: DINs, subst PV (0=Allow, 1=DisAllow) Parameter: various, individual per channel
DI = 1 = Active Status	List: 09: Digital Input Channel Configuration Parameter: various, individual per channel
Use This Signal	List: 09: Digital Input Channel Configuration Parameter: various, individual per channel

Customize the Channel

From the device configuration, you may edit the description. This represents a string tag in the HMI (not the controller). This tag is retentive and saved in the HMI memory. For example, you may want to include the device tag number in the description and identify the signal more clearly (for example: “PSL-1014 Low Lube Oil Pressure”).

String Tag limits are:

Description: 34 characters

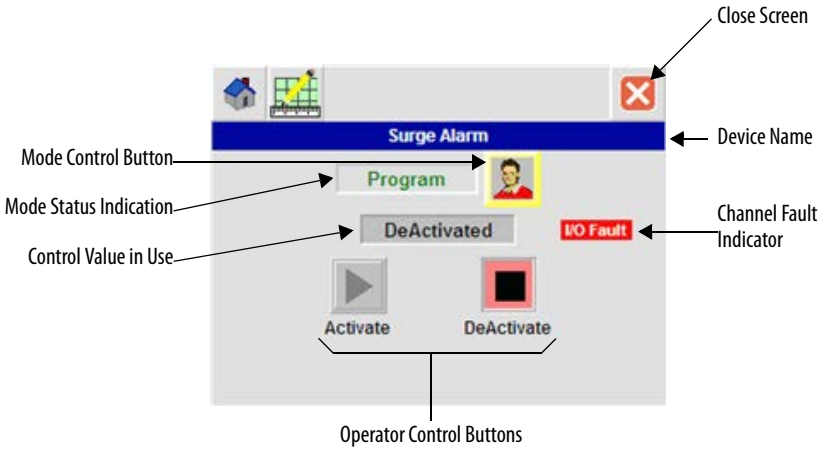
Digital Output Device Faceplate

The Digital Output Device faceplate provides a graphical interface to the operational and configurable behaviors of the digital output channels.

Digital Output Device Operation

Press to display the Operations page. The following illustration details the features of the Device Operation page.

Figure 35 - Digital Output Faceplate – Operations Page



The digital output device supports two modes of operation: 1) Program, and 2) Operator.

Under normal operations, the mode should be Program. In Program mode the application program and interlocks determine the control value (CV) in use. When the device is in Program mode, the operator CV value automatically tracks the CV value in use. This makes the transition to Operator mode bumpless.

Operator mode is intended only for device maintenance and testing when the compressor is not running. When in Operator mode, the operator control buttons can be used to set the control value. Use of Operator mode sets the permissive, digital outputs OK, to not-ready.

When the compressor is running, the device mode is automatically set to Program mode, and the mode control button is not available. When the compressor is not running, the mode control button is presented on the screen.

Current Mode	Mode Button	Button Action
Program	None	The compressor is running, mode change not available.
Program		Pressing the button switches the mode to Operator.
Operator		Pressing the button switches the mode to Program.

The mode buttons and operator control buttons require security privileges (operator, supervisor, maintenance, or engineer).

Digital Output Device Configuration

Press to display the Configuration page. Many of the digital output channel configuration parameters may be adjusted on this page.

Figure 36 - Digital Output Faceplate – Configuration Page

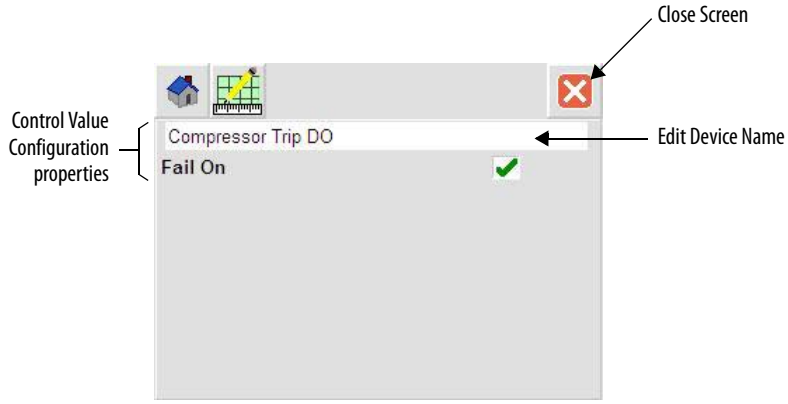


Table 78 lists the configuration items displayed on the Digital Output Faceplate - Configuration page and the corresponding parameter lists and parameter numbers used for configuration.

Table 78 - Digital Output Device Configuration Parameter List Cross Reference

Faceplate Configuration Item	Parameter List / Parameter Number
Fail On	List: 10: Digital Output Channel Configuration Parameter: various, individual per channel

Customize the Channel

From the device configuration, you may edit the description. This represents a string tag in the HMI (not the controller). This tag is retentive and saved in the HMI memory. For example, you may want to include the device tag number in the description and identify the signal more clearly (for example: “XA-1004 Surge Alarm”).

String tag limits are:

Description: 34 characters

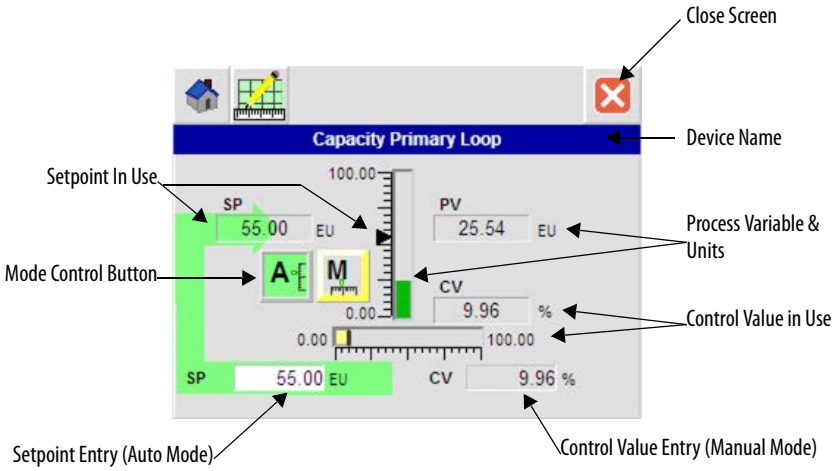
PID Loop Faceplate

The PID Loop faceplate provides a graphical interface to the anti-surge and capacity control PID loops. The PID faceplate has an Operations page and a Configuration page.

PID Loop Device Operation

Press to display the Operations page. The following illustration details the features of the PID loop Operation page.

Figure 37 - PID Faceplate – Operations Page



The PID loop is a Proportional - Integral - Derivative controller used for regulatory control applications. The PID loop is used for both anti-surge and capacity control within the SSCC system.

Loop Mode

The mode buttons provide both control and indication of the Loop mode.

Mode Buttons	Indication Description	Operation available
A M	Loop is in Manual	None, security privilege required (O, S, M or E)
A M	Loop is in Auto	None, security privilege required (O, S, M or E)
A M	Loop is in Manual	Press A to switch to Auto Mode
A M	Loop is in Auto	Press M to switch to Manual Mode

For the anti-surge primary PID loop, the application provides a mode protection feature to switch the loop from Manual back to Auto mode when the operating point is within a certain distance of the surge limit line. This prevents the operator from driving the compressor into surge. This protection feature is bypassed when surge testing is enabled. The anti-surge secondary PID loop and the capacity PID loops do not incorporate this mode protection.

When all configured loops are in Auto mode, the control loops ready permissive is generated. If operational procedures for the compressor require one or more of the configured loops to be in Manual mode at startup, then this permissive may need to be configured for bypass.

Loop Setpoint

When the PID loop is in Auto mode, the setpoint of the loop may be adjusted (security privilege required: O, S, M or E). Setpoint entry is limited by the configured SP Minimum and SP Maximum values. When a new setpoint is entered, the setpoint in use will adjust to the new target value at the configured SP Increase and Decrease limits.

For the anti-surge primary PID loop, the loop setpoint is determined by the application logic (SCL value from the OP tracking function). While the faceplate provides SP entry, the application will over write any entered value from the HMI.

Manual Control Value

When the loop is in Manual mode, the manual control value can be adjusted (security privilege required: O, S, M or E). Control value entry is limited by the configured CV Minimum and CV Maximum values.

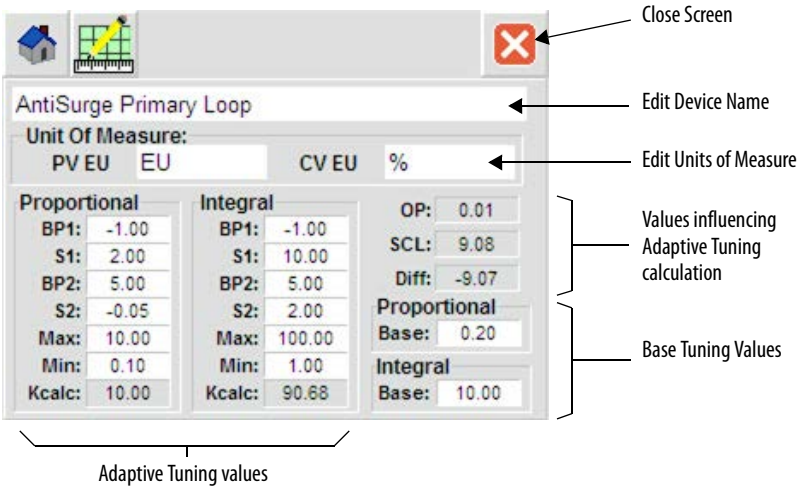
PID Loop Device Configuration

Press to display the Configuration page. There are two types of Configuration pages for the PID loop: 1) Standard Tuning, 2) Adaptive Tuning. The anti-surge primary PID loop uses the Adaptive Tuning configuration page, and the other PID loops use the Standard Tuning configuration page.

Configuration Page – Adaptive Tuning

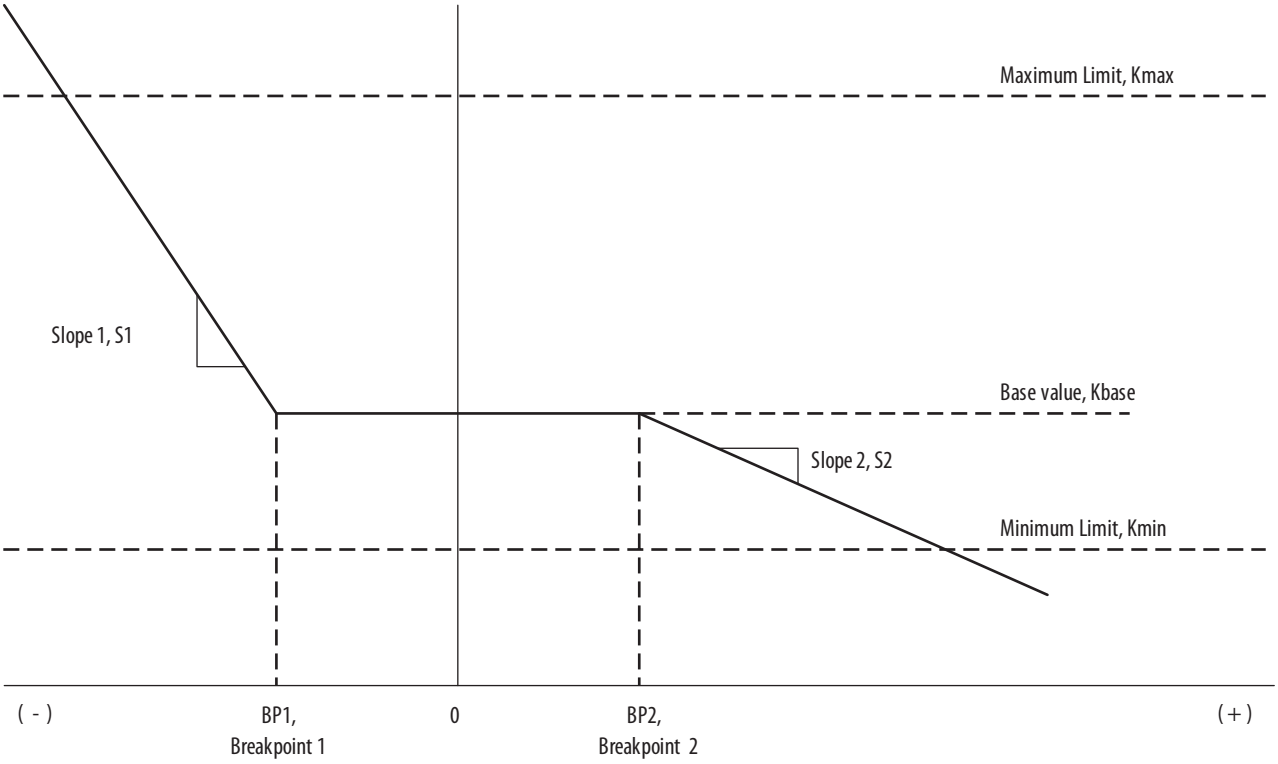
The following illustration details the features of the PID Adaptive Tuning Configuration page used for the anti-surge primary PID loop.

Figure 38 - PID Faceplate – Adaptive Tuning Configuration Page



Adaptive tuning is used to automatically adjust the proportional and integral tuning values based on operating conditions. The adaptive tuning adjustment principles are illustrated in the following figure.

Figure 39 - Adaptive Tuning Principles



The controller calculates the difference between the operating point and the surge control line = (OP – SCL). These values are shown on the Configuration page. When difference between the operating point and the surge control line (Diff) is between the breakpoints, the base tuning value is used. When the Diff is

outside the breakpoints, the tuning value is calculated based on the slopes S1 or S2. A positive value for slope increases the tuning value (slope 1 in the illustration). A negative value for slope decreases the tuning value (slope 2 in the illustration). The calculated adaptive tuning value is shown as Kcalc on the Configuration page. The calculated value is clamped at the configured minimum and maximum limits.

Table 79 lists the configuration items displayed on the PID Loop Faceplate - Adaptive Tuning Configuration page and the corresponding parameter lists and parameter numbers used for configuration.

Table 79 - PID Loop - Adaptive Tuning Configuration Parameter List Cross Reference

Faceplate Configuration Item	Security	Parameter List / Parameter
Proportional – BP1	E or A	List 18, Param 04: BreakPoint 1 (%)
Proportional – S1	E or A	List 18, Param 06: Slope 1 (Gain / %)
Proportional – BP2	E or A	List 18, Param 05: BreakPoint 2 (%)
Proportional – S2	E or A	List 18, Param 07: Slope 2 (Gain / %)
Proportional – Max	E or A	List 18, Param 02: Max Proportional (Gain)
Proportional – Min	E or A	List 18, Param 03: Min Proportional (Gain)
Proportional - Base	M, E or A	List 18, Param 01: Base Proportional (Gain)
Integral – BP1	E or A	List 17, Param 04: BreakPoint 1 (%)
Integral – S1	E or A	List 17, Param 06: Slope 1 (Rpt/min / %)
Integral – BP2	E or A	List 17, Param 05: BreakPoint 2 (%)
Integral – S2	E or A	List 17, Param 07: Slope 2 (Rpt/min / %)
Integral – Max	E or A	List 17, Param 02: Max Integral (Rpt/min)
Integral – Min	E or A	List 17, Param 03: Min Integral (Rpt/Min)
Integral – Base	M, E or A	List 17, Param 01: Base Integral (Rpt/min)

Customize the Loop

From the device configuration, you may edit the description, and the units of measure. These represent string tags in the HMI (not the controller). These tags are retentive and saved in the HMI memory. For example, you may want to include the device tag number in the description (for example: “UIC-1007 AntiSurge Control”). You may also set the units of measure if desired. Note that for the anti-surge primary PID loop, the PV is always the calculated operating point, which is normalized 0...100% value. The control value of the PID loop is intended to represent a control signal as 0...100% open.

String Tag limits are:

Description: 34 characters

Unit of Measure: 6 characters

Configuration Page – Standard Tuning

The following illustration details the features of the PID Standard Tuning Configuration page used with the anti-surge secondary PID loop and both capacity PID loops.

Figure 40 - PID Faceplate – Standard Tuning Configuration Page

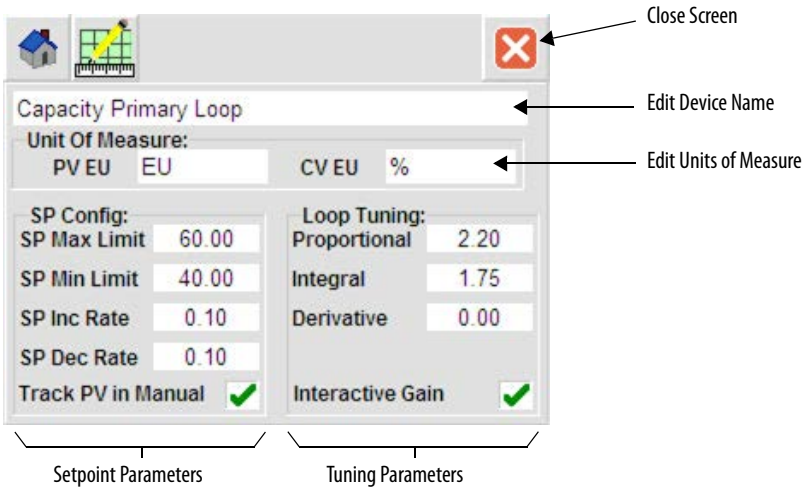


Table 80 lists the configuration items displayed on the PID Loop Faceplate - Standard Tuning Configuration page and the corresponding parameter lists and parameter numbers used for configuration.

Table 80 - PID Loop - Standard Tuning Configuration Parameter List Cross Reference

Faceplate Configuration Item	Security	Parameter List Cross Reference List 19: Anti-Surge Secondary PID Loop List 21: Capacity Primary PID Loop List 22: Capacity Secondary PID Loop
SP Max Limit	M, E or A	Param 04: SP Max Limit (EU)
SP Min Limit	M, E or A	Param 05: SP Min Limit (EU)
SP Inc Rate	M, E or A	Param 06: SP Inc Limit (EU/sec)
SP Dec Rate	M, E or A	Param 07: SP Dec Limit (EU/sec)
Track PV in Manual (check box)	E or A	Param 03: SP Track PV in Man(1=Y)
Proportional	M, E or A	Param 08: Proportional (Gain)
Integral	M, E or A	Param 10: Integral (Rpt/min)
Derivative	M, E or A	Param 11: Derivative (sec)
Interactive Gain (check box)	E or A	Param 12: Interactive Tuning (1=Y)

Customize the Loop

From the configuration page, you may edit the description, and the units of measure. These represent string tags in the HMI (not the controller). These tags are retentive and saved in the HMI memory. For example, you may want to name the loop based on tag number and function (for example: "PIC-1012 Discharge Press Control"). You may also set the units of measure if desired. For example, set the units for PV (also used for SP) to "psia". The control value of the PID loop is intended to represent a control signal as 0...100% open.

String tag limits are:

Description: 34 characters

Unit of Measure: 6 characters

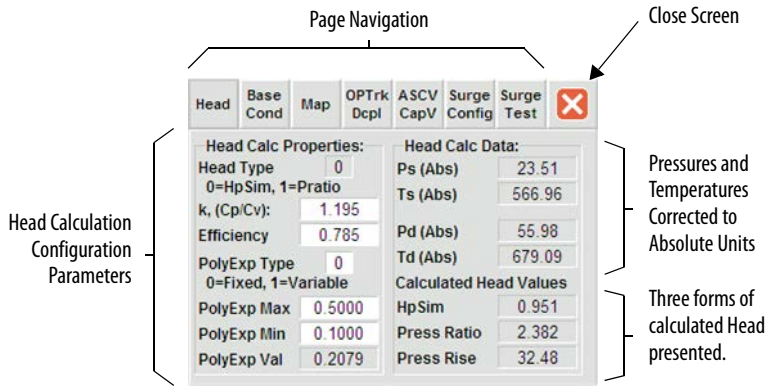
Compressor Details Faceplate

The Compressor Details faceplate provides an interface to the many of the operational and configuration details associated with the compressor. These details are organized into seven groups represented by tabs along the top of the faceplate.

Compressor Details - Head Page

Press Head to display the Compressor Details - Head page. The following illustration details the features of the page.

Figure 41 - Compressor Details – Head Page



This page provides access to configuration details and calculated values pertaining to the compressor head calculation.

Table 81 lists the configuration items displayed on the Compressor Details - Head page and the corresponding parameter lists and parameter numbers used for configuration.

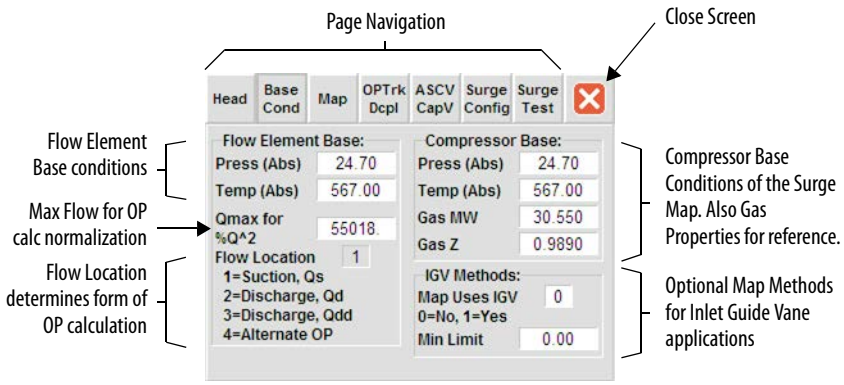
Table 81 - Compressor Details - Head Faceplate Information Parameter List Cross Reference

Faceplate Configuration Item	Security	Parameter List / Parameter
Head Type 0=HpSim, 1=Pratio (read only)	E or A	List 11, Param 08: Head(0=HpSim,1=Pratio)
k, (Cp/Cv)	E or A	List 11, Param 03: Ratio of Specific Heats
Efficiency	E or A	List 11, Param 04: Polytropic Efficiency(0 - 1)
PolyExp Type (0=Fixed, 1=Variable)	E or A	List 11, Param 09: PolyExp(0=Const,1=Var)
PolyExp Max	E or A	List 11, Param 10: Var Poly Exp Max (EU)
PolyExp Min	E or A	List 11, Param 11: Var Poly Exp Min (EU)

Compressor Details - Base Condition Page

Press Base Cond to display the Compressor Details - Base Conditions page. The following illustration details the features of the page.

Figure 42 - Compressor Details – Base Conditions Page



This page provides access to configuration details pertaining to the operating point calculation and inlet guide vane methods for the surge map.

Table 82 lists the configuration items displayed on the Compressor Details - Base Conditions page and the corresponding parameter lists and parameter numbers used for configuration.

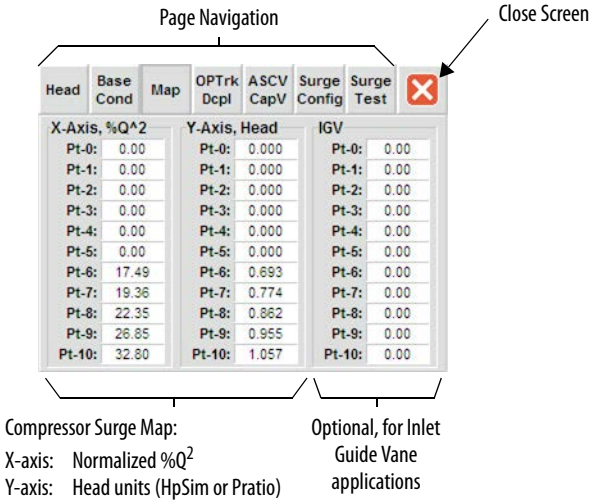
Table 82 - Compressor Details - Base Conditions Faceplate Information Parameter List Cross Reference

Faceplate Configuration Item	Security	Parameter List / Parameter
Flow Element Base – Press (Abs)	E or A	List 11, Param 06: Orifice Base Press (Abs)
Flow Element Base – Temp (Abs)	E or A	List 11, Param 05: Orifice Base Temp (Abs)
Qmax for $\%Q^2$	E or A	List 11, Param 07: Max Flow, Qmax (EU)
Flow Location (read only)	E or A	List 01, Param 01: Qs=1,Qd=2,Qdd=3,Alt=4
Compressor Base – Press (Abs)	E or A	List 11, Param 02: Comp Base Press (Abs)
Compressor Base – Temp (Abs)	E or A	List 11, Param 01: Comp Base Temp (Abs)
Compressor Base – Gas MW	E or A	List 11, Param 14: Gas Molecular Weight
Compressor Base – Gas Z	E or A	List 11, Param 15: Gas Compressibility
IGV Methods – Map Uses IGV (0=No, 1=Yes)	E or A	List 11, Param 12: Map using IGV (1=Yes)
IGV Methods – Min Limit	E or A	List 11, Param 13: IGV Min Limit (0 - 100)

Compressor Details - Surge Map Page

Press Map to display the Compressor Details - Surge Map page. The following illustration details the features of the page.

Figure 43 - Compressor Details – Surge Map Page



This page provides access to configuration values that define the Compressor Details - Surge Map.

Table 83 lists the configuration items displayed on the Compressor Details - Surge Map page and the corresponding parameter lists and parameter numbers used for configuration.

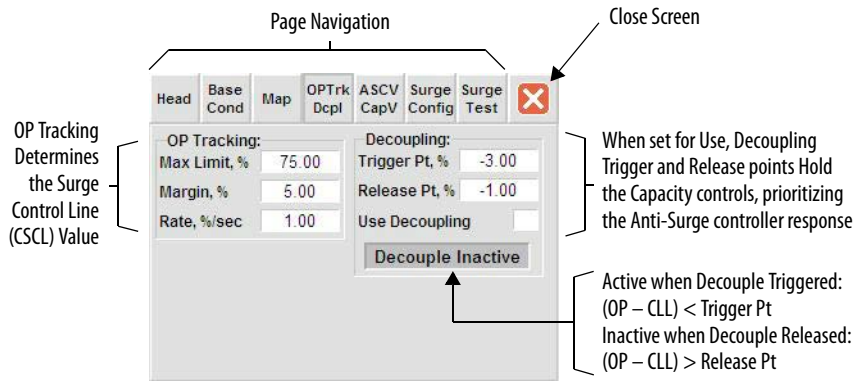
Table 83 - Compressor Details - Surge Map Faceplate Information Parameter List Cross Reference

Faceplate Configuration Item	Security	Parameter List / Parameter
X-axis, $\%Q^2$, Points 0 to 10	E or A	List 12, Param 01: $\%Q^2$, Pt 0 through List 12, Param 11: $\%Q^2$, Pt 10
Y-axis, Head, Points 0 to 10	E or A	List 12, Param 12: Comp Head, Pt 0 through List 12, Param 22: Comp Head, Pt 10
IGV, Points 0 to 10	E or A	List 12, Param 23: Inlet Guide Vane, Pt 0 through List 12, Param 33: Inlet Guide Vane, Pt 10

Compressor Details - OP Tracking and Decoupling Page

Press OPTrk Dcpl to display the Compressor Details - OP Tracking and Decoupling page. The following illustration details the features of the page.

Figure 44 - Compressor Details – OP Tracking / Decoupling Page



This page provides access to configuration values that define the OP tracking behavior and the anti-surge/capacity control decoupling behavior of the system.

Table 84 lists the configuration items displayed on the Compressor Details - OP Tracking and Decoupling page and the corresponding parameter lists and parameter numbers used for configuration.

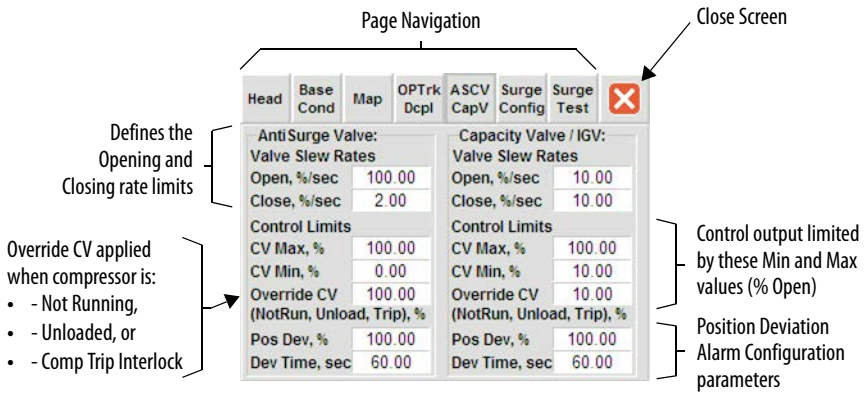
Table 84 - Compressor Details - OP Tracking/Decoupling Faceplate Information Parameter List Cross Reference

Faceplate Configuration Item	Security	Parameter List / Parameter
OP Tracking – Max Limit, %	M, E or A	List 13, Param 16: OP Track Max SP (%)
OP Tracking – Margin, %	M, E or A	List 13, Param 14: OP Track Margin (%)
OP Tracking – Rate, %/sec	M, E or A	List 13, Param 15: OP Track Rate (%/sec)
Decoupling – Trigger Pt, %	M, E or A	List 23, Param 02: DP1, Initiate Pt (ASC EU)
Decoupling – Release Pt, %	M, E or A	List 23, Param 03: DP2, Release Pt (ASC EU)
Decoupling – Use Decoupling (check box)	E or A	List 23, Param 01: Use Decoupling (1=Yes)

Compressor Details - Anti-Surge and Capacity Valve Page

Press ASCV CapV to display the Compressor Details - Anti-Surge and Capacity Valve page. The following illustration details the features of the page.

Figure 45 - Compressor Details – Anti-Surge and Capacity Valve Page



This page provides access to configuration of control behaviors (control rates, control limits, and position alarms) associated with the anti-surge valve and the capacity control device (valve, IGV, etc.).

Table 85 lists the configuration items displayed on the Compressor Details - Anti-Surge and Capacity Valve page and the corresponding parameter lists and parameter numbers used for configuration.

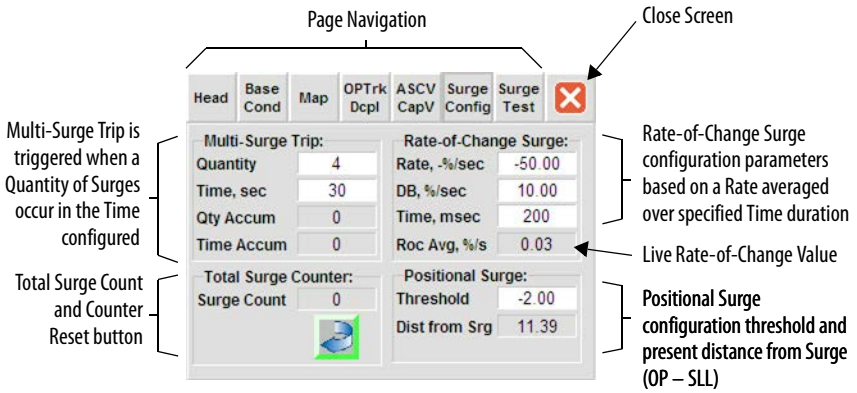
Table 85 - Compressor Details – Anti-Surge and Capacity Valve Faceplate Information Parameter List Cross Reference

Faceplate Configuration Item	Security	Parameter List / Parameter		
		List 15, AntiSurge	List 20, Capacity	Function
Valve Slew Rate – Open, %/sec	M, E or A	Param 05:	Param 05:	OpenSlewRate (%/sec)
Valve Slew Rate – Close, %/sec	M, E or A	Param 06:	Param 06:	CloseSlewRate (%/sec)
Control Limit – CV Max, %	M, E or A	Param 07:	Param 07:	CV Max (%)
Control Limit – CV Min, %	M, E or A	Param 08:	Param 08:	CV Min (%)
Override CV (NotRun, Unload, Trip) %	M, E or A	Param 02:	Param 02:	Not Running CV (%)
Position Deviation – Pos Dev, %	M, E or A	Param 11:	Param 10:	Pos Dev Alm DB (%)
Position Deviation – Dev Time, sec	M, E or A	Param 12:	Param 11:	Pos Dev Alm Time (sec)

Compressor Details - Surge Configuration Page

Press Surge Config to display the Compressor Details - Surge Configuration page. The following illustration details the features of the page.

Figure 46 - Compressor Details – Surge Configuration Page



This page provides access to configuration values pertaining to surge detection methods (rate-of-change, and positional), multi-surge trip, and surge counters for the compressor.

Table 86 lists the configuration items displayed on the Compressor Details - Surge Configuration page and the corresponding parameter lists and parameter numbers used for configuration.

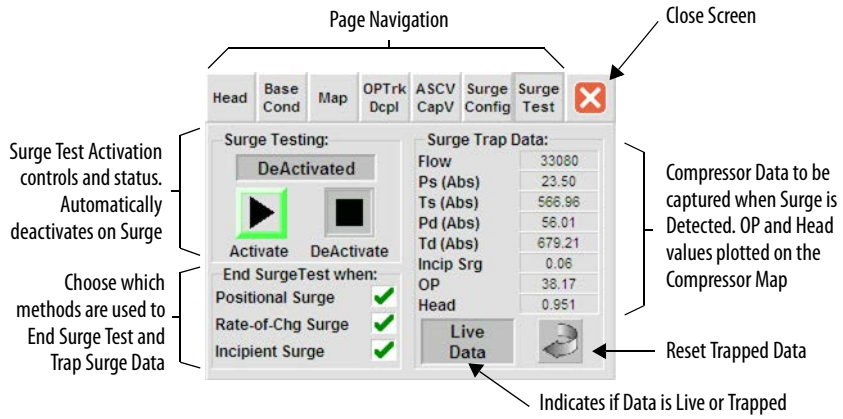
Table 86 - Compressor Details – Surge Configuration Faceplate Information Parameter List Cross Reference

Faceplate Configuration Item	Security	Parameter List / Parameter
Multi-Surge Trip – Quantity	E or A	List: 13, Param 08: Surge Trip Qty
Multi-Surge Trip – Time, sec	E or A	List: 13, Param 09: Surge Trip Time (sec)
Rate-of-Change Surge – Rate, -%.sec	M, E or A	List: 13, Param 10: Surge RoC Low (-%/sec)
Rate-of-Change Surge – DB, %,sec	M, E or A	List: 13, Param 11: Surge RoC DB (%/sec)
Rate-of-Change Surge – Time, msec	M, E or A	12: Surge RoC Time (msec)
Positional Surge – Threshold	M, E or A	13: Positional Srg Margin (%)

Compressor Details - Surge Test Page

Press Surge Test to display the Compressor Details - Surge Test page. The following illustration details the features of the page.

Figure 47 - Compressor Details – Surge Test Page



This page is used during surge testing the compressor. Use this page to do the following tasks.

- Activate/deactivate surge testing
- Choose the surge methods used to end the test and trap data
- Examine trapped surge data
- Reset trapped data

The above operations require security privilege engineer or administrator.

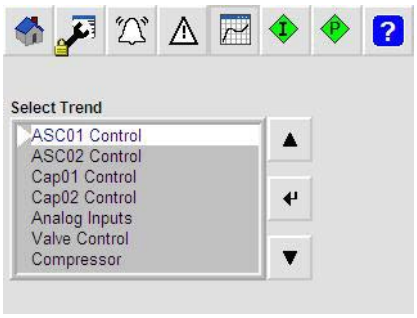
Trends

The SSCC HMI includes several trend displays which graph key control and operating data on convenient time plots.

Follow these steps to navigate and select a particular trend display.

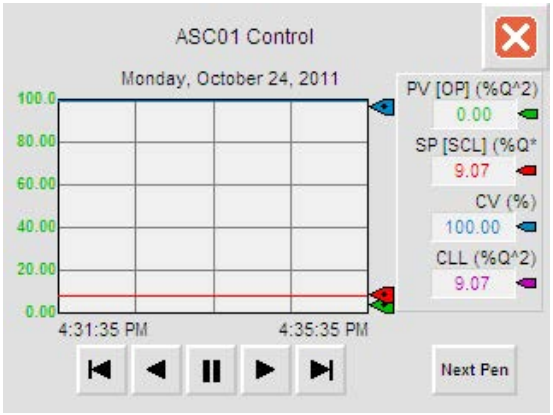
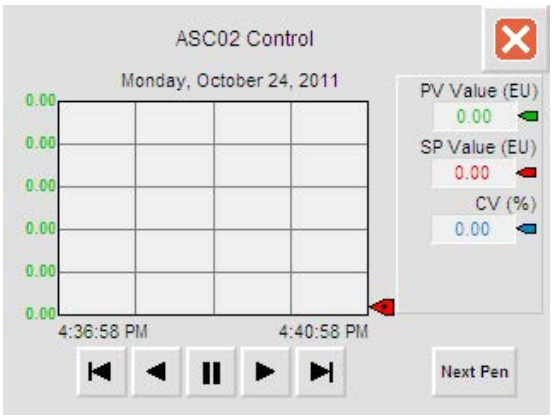
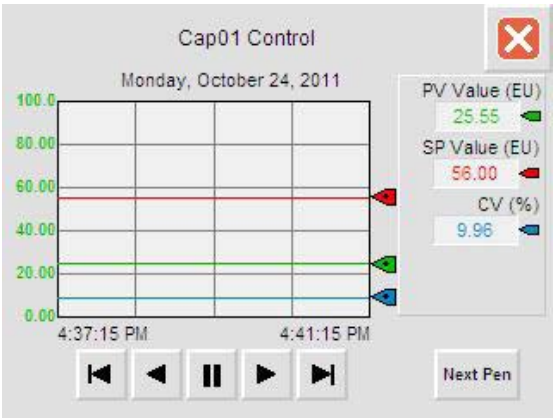
1. Press to close any open pop-up screens and return to a main screen showing the navigation toolbar.
2. Press on the navigation toolbar.

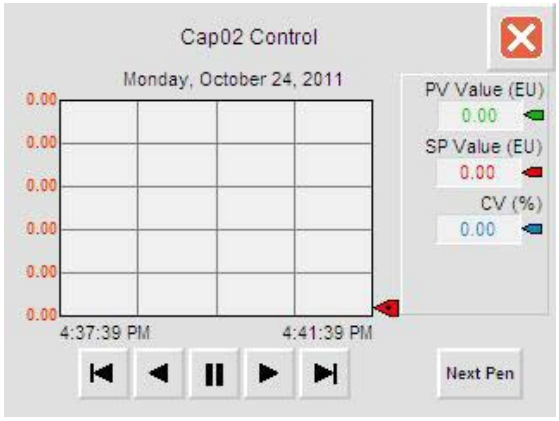
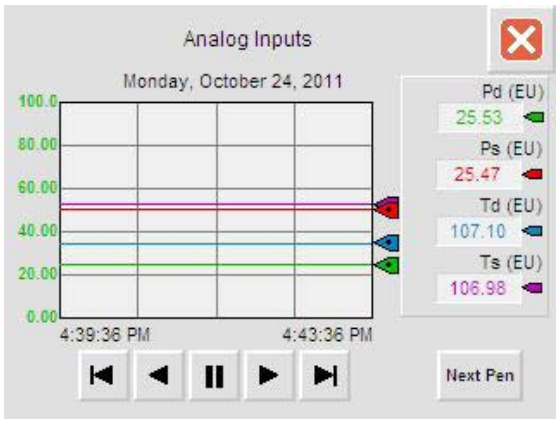
   The Trend Select screen appears as shown here.

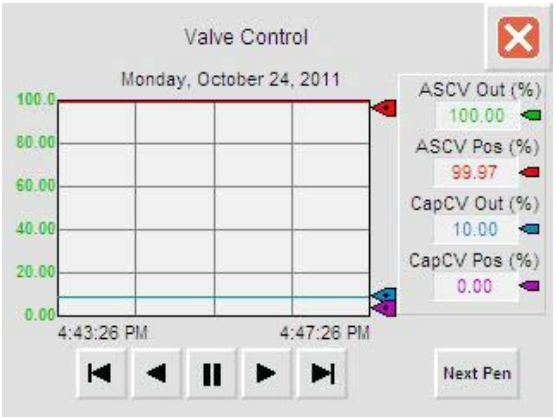
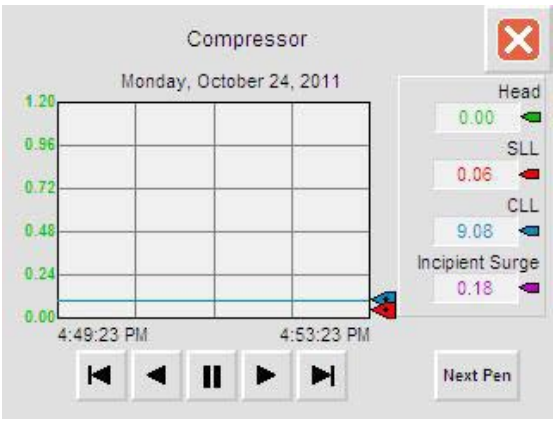
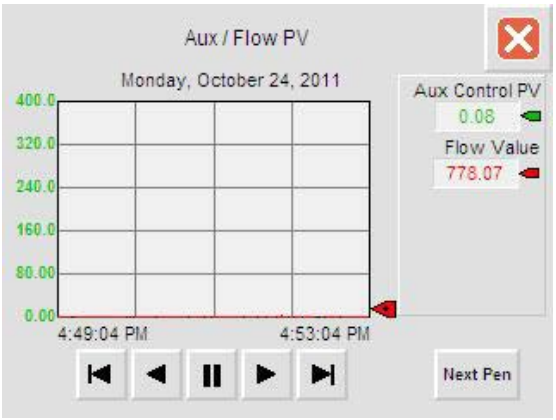


3. Press or to select the trend in the list that you want to view.
4. Press to open the selected Trend Detail screen.

There are eight pre-configured Trend Detail screens. The following table contains an example and description of the variables available on each Trend Detail screen.

Trend Detail	Description / Variables	Example Screen
ASC01 Control	Anti-Surge Primary PID Loop variables: Loop PV: the calculated Operating Point value, OP Loop SP: the Surge Control Line value, SCL Loop CV: the PID output Control Value CLL value: Control Limit Line value, represents the minimum SP for the loop	
ASC02 Control	Anti-Surge Secondary PID Loop variables (if configured) Loop PV: Process Variable, as configured Loop SP: Setpoint Loop CV: The PID output Control Value	
Cap01 Control	Capacity Primary PID Loop variables (if configured) Loop PV: Process Variable, as configured Loop SP: Setpoint Loop CV: The PID output Control Value	

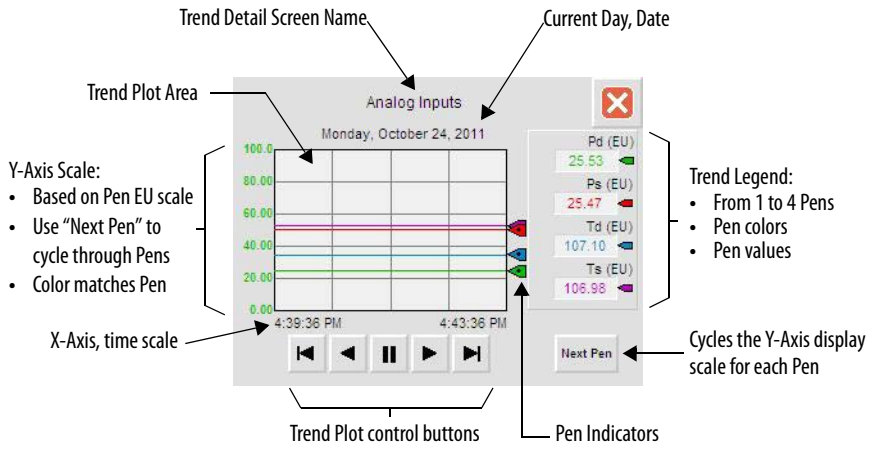
Trend Detail	Description / Variables	Example Screen
Cap02 Control	Capacity Secondary PID Loop variables (if configured) Loop PV: Process Variable, as configured Loop SP: Setpoint Loop CV: The PID output Control Value	
Analog Inputs	Pressure and Temperature signals Discharge Pressure, Pd Suction Pressure, Ps Discharge Temperature, Td Suction Temperature, Ts	

Trend Detail	Description / Variables	Example Screen
Valve Control	Anti-Surge and Capacity Valve signals ASC Valve Control Output ASC Valve Position signal input Capacity Valve/Device Control Output Capacity Valve/Device Position signal input	
Compressor	Compressor values of interest Compressor Head value Surge Limit Line value, SLL Control Limit Line value, CLL Incipient Surge input signal (if configured)	
Aux / Flow PV	Auxiliary Control Signal and Compressor Flow Auxiliary Control PV input signal (if configured) Compressor Flow input signal (as configured: Qs, Qd, Qdd, or Qalt)	

Using the Trend Detail Screen

Features common to all of the Trend Detail screens are illustrated in Figure 48.

Figure 48 - Trend Details Screen



The trend plot area is configured to display four minutes of trend data. Trend data scrolls from right to left. For each pen, the trend legend identifies the variable, the pen color, and the current value. Each pen indicator's vertical position along the right edge of the plot area follows the current value of the pen. The Y-axis scale only presents one pen scale at a time. To switch the Y-axis scale, use the next pen button to cycle through the available pens. The color of the Y-axis values follows the pen color.

The trend plot control buttons allow the user to scroll through trend data buffered by the display. The functions for each button are described here.

Button	Name	Function
⏮	Home	Scroll trend plot back to earliest trend data in display buffer and Pause
◀	Scroll Left	Scroll trend plot back 2-minutes and Pause
⏸	Pause / Resume	If trend plot is Live, then Pause If trend plot is Paused, then resume Live updates
▶	Scroll Right	Scroll trend plot forward 2-minutes and Pause
⏭	End	Scroll trend plot forward to most recent trend data and Resume Live update

Trend Technical Specifications

Trend Plot area:	
X-Axis, Time scale	4-minutes (fixed)
Y-Axis	Pre-configured to EU range of Pen(s)
Trend Sampling	1-second
Trend History	
Trend Log	240 samples (4-minutes) available on Trend Open
Display Buffer	4800 samples (80-minutes) while screen open. Clears when screen closed.

Modbus Interface

The SSCC has a RS-232 serial port for Modbus communication. The port is located on the front of the controller. The protocol supported is RTU in slave mode.

Serial Port Configuration

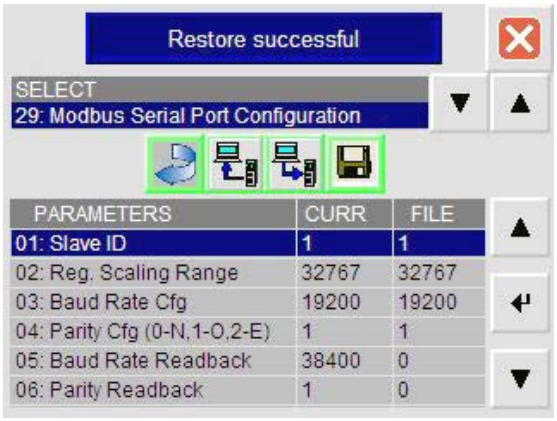
The following table shows the parameters related to Modbus communication.

Table 87 - Modbus Communication Parameters

Parameter	Description	Range
1	Slave ID	1…254
2	Register Scaling Range	0…32767
3	Baud Rate Configuration	0…38400
4	Parity Configuration (0=None, 1=Odd, 2=Even)	0…2
5	Baud Rate Read back	0…38400
6	Parity Read back	0…2
7	Set Port Config (1=Set Port Config)	0…1

Configuration of the Modbus interface is performed through the HMI. Refer to configuration details for parameter list 29: Modbus Serial Port Configuration on page 87.

Figure 49 - Modbus Serial Port Configuration Screen



Modbus Holding Registers

Modbus data access to the SSCC utilizes only Modbus holding registers. Modbus function code 3 can be used to read these registers.

The map of Modbus registers is presented in the following table. Where indicated, the SSCC EU (engineering unit) value range is converted to the Modbus register range configured in parameter 2.

Table 88 - Modbus Holding Register Assignments

Address	Data Type	EU Range	Service
40001	INT	0.0 to 100.0	ASC Primary PID Loop – Process Value (Operating Point, OP)
40002	INT	0.0 to 100.0	ASC Primary PID Loop – Setpoint in Use
40003	INT	0.0 to 100.0	ASC Primary PID Loop – Control Value
40004	INT	EU Min to EU Max	Compressor Flow input signal
40005	INT	EU Min to EU Max	Suction Pressure input signal
40006	INT	EU Min to EU Max	Suction Temperature input signal
40007	INT	EU Min to EU Max	Discharge Pressure input signal
40008	INT	EU Min to EU Max	Discharge Temperature input signal
40009	INT	0.0 to 100.0	Incipient Surge input signal
40010	INT	0.0 to 100.0	ASC Valve Position input signal
40011	INT	0.0 to 100.0	CAP Valve/IGV Position input signal
40012	INT	0.0 to 10.0	Compressor Head (HpSim or Pratio)
40013	INT	0.0 to 100.0	Surge Limit Line, SLL
40014	INT	0.0 to 100.0	Control Limit Line, CLL
40015	INT	0.0 to 100.0	Surge Control Line, SCL ASC Primary PID Loop - Setpoint
40016	INT	0.0 to 100.0	Surge Map X-Axis, Pt-0
40017	INT	0.0 to 100.0	Surge Map X-Axis, Pt-1
40018	INT	0.0 to 100.0	Surge Map X-Axis, Pt-2
40019	INT	0.0 to 100.0	Surge Map X-Axis, Pt-3
40020	INT	0.0 to 100.0	Surge Map X-Axis, Pt-4
40021	INT	0.0 to 100.0	Surge Map X-Axis, Pt-5
40022	INT	0.0 to 100.0	Surge Map X-Axis, Pt-6
40023	INT	0.0 to 100.0	Surge Map X-Axis, Pt-7
40024	INT	0.0 to 100.0	Surge Map X-Axis, Pt-8
40025	INT	0.0 to 100.0	Surge Map X-Axis, Pt-9
40026	INT	0.0 to 100.0	Surge Map X-Axis, Pt-10
40027	INT	0.0 to 10.0	Surge Map Y-Axis, Pt-0
40028	INT	0.0 to 10.0	Surge Map Y-Axis, Pt-1
40029	INT	0.0 to 10.0	Surge Map Y-Axis, Pt-2
40030	INT	0.0 to 10.0	Surge Map Y-Axis, Pt-3
40031	INT	0.0 to 10.0	Surge Map Y-Axis, Pt-4
40032	INT	0.0 to 10.0	Surge Map Y-Axis, Pt-5
40033	INT	0.0 to 10.0	Surge Map Y-Axis, Pt-6

Table 88 - Modbus Holding Register Assignments (Continued)

Address	Data Type	EU Range	Service
40034	INT	0.0 to 10.0	Surge Map Y-Axis, Pt-7
40035	INT	0.0 to 10.0	Surge Map Y-Axis, Pt-8
40036	INT	0.0 to 10.0	Surge Map Y-Axis, Pt-9
40037	INT	0.0 to 10.0	Surge Map Y-Axis, Pt-10
40038	INT	EU Min to EU Max	ASC Secondary PID Loop – Process Value
40039	INT	EU Min to EU Max	ASC Secondary PID Loop – Setpoint Target
40040	INT	EU Min to EU Max	ASC Secondary PID Loop – Setpoint in Use
40041	INT	0.0 to 100.0	ASC Secondary PID Loop – Control Value
40042	INT	EU Min to EU Max	Capacity Primary PID Loop – Process Value
40043	INT	EU Min to EU Max	Capacity Primary PID Loop – Setpoint Target
40044	INT	EU Min to EU Max	Capacity Primary PID Loop – Setpoint in Use
40045	INT	0.0 to 100.0	Capacity Primary PID Loop – Control Value
40046	INT	EU Min to EU Max	Capacity Secondary PID Loop – Process Value
40047	INT	EU Min to EU Max	Capacity Secondary PID Loop – Setpoint Target
40048	INT	EU Min to EU Max	Capacity Secondary PID Loop – Setpoint in Use
40049	INT	0.0 to 100.0	Capacity Secondary PID Loop – Control Value
40050	INT	0.0 to 100.0	Capacity Valve/IGV Control Output
40051	INT	0.0 to 100.0	Total Margin in Use
40052	INT	No scaling	Surge Counter
40053	INT	0.0 to 100.0	Reserved for future use
40054	INT	0.0 to 100.0	Reserved for future use
40055	INT	0.0 to 100.0	Reserved for future use
40056	INT	0.0 to 100.0	Reserved for future use
40057	INT	0.0 to 100.0	Reserved for future use
40059	INT	0.0 to 100.0	Reserved for future use
40060	INT	0.0 to 100.0	Reserved for future use

Notes:

Troubleshooting

This section covers topics to help troubleshooting the SSCC during commissioning or during its normal lifecycle.

System Power

The SSCC field signals should be connected to the marshaling terminals indicated on Chapter 3 of this manual. All internal wiring is completed at the factory; therefore signal troubleshooting is limited to checking the functioning of the power supplies, circuit breakers and fuses. This guide is not intended for troubleshooting field signals. All field signals should be tested using the field loop drawings.

Make sure you have a set of system drawings before starting to troubleshoot.

Table 89 - Troubleshooting Matrix

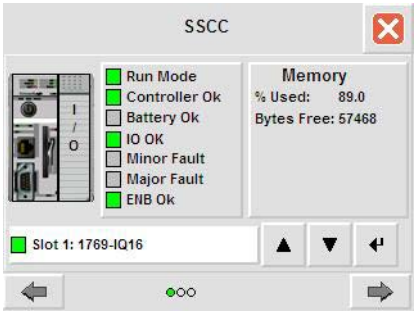
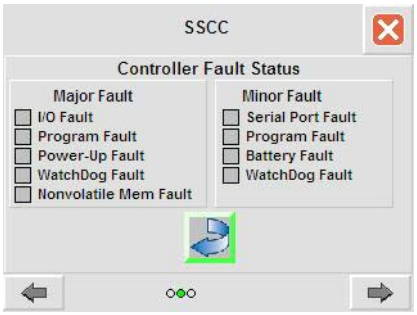
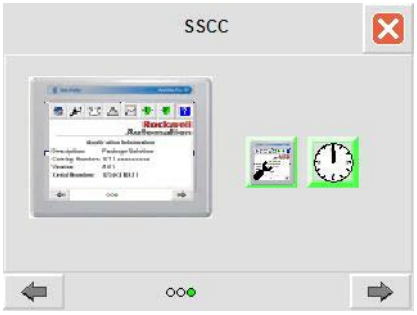
Symptom	Suggestions
General power related symptoms	If the system is powered from an AC source: • Make sure 120 VAC is available at CB1. • Make sure CB1 is in the "On" position. If the system is powered from a DC source: • Check voltage on 24VDC input power terminals 24V-1 (+) 24V-2 (-)
Controller fails to power up	Check the suggestions for "General power related symptoms" above Check the voltage on terminals TS3-1 and TS3-2 (24VDC) Check the fuse (2A) on TS3-1
PanelView fails to power up	Check the suggestions for "General power related symptoms" above Check the voltage on terminals TS3-15 and TS3-16 (24VDC) Check the fuse (1A) on TS3-15
Digital Inputs not working	Check the suggestions for "General power related symptoms" above Check the voltage on terminals TS3-5 and TS3-6 (24 VDC) Check the fuse (1A) on TS3-5 (common power to all DIN channels) Check the individual channel fuses (0.25A) on TS1
Digital Outputs not working	Check the suggestions for "General power related symptoms" above Check the voltage on terminals TS3-7 and TS3-8 (24 VDC) Check the f use (5A) on TS3-7 (common power to all DOUT channels) Check the individual channel fuses (0.5A) on TS2
Analog Inputs not working	Check the suggestions for "General power related symptoms" above Check the voltage on terminals TS3-3 and TS3-4 (24 VDC) Check the fuse (1A) on TS3-3 (common power to all AIN channels) Check the individual channel fuses (0.25A) on TS1
Analog Output not working	Check the suggestions for "General power related symptoms" above Note: 24V DC power for AO channels are sourced from the controller power supply. Check the individual channel fuses (0.25A) on TS1

Hardware Status

The Hardware screen on the HMI provides detailed status of the controller, I/O modules, I/O channels, and access to the HMI configuration (exit graphics).

The Hardware screen has three pages to support troubleshooting/maintenance activities the SSCC hardware. When the Hardware screen opens, the last viewed page is presented to the user.

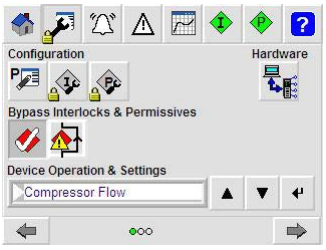
Table 90 - Hardware Screen Pages

Page	Screen Examples	Description
1		Hardware Screen – Controller Status Display Features: • Controller status indications: Mode, Controller, Battery, I/O System, Minor Faults, Major Faults and Ethernet. • Memory usage statistics. Operational Features: • Use ▲ or ▼ to check the status of the individual modules. • Press ↵ to open a Module Detail popup for the chosen I/O module.
2		Hardware Screen – Major / Minor Faults Display Features: • Detailed major fault and minor fault status. Operational Features: • Press to reset major and minor faults - security privilege required (O, S, M, E, or A).
3		Hardware Screen – PanelView Plus Maintenance Operational Features: Press to exit the HMI graphics and access the PanelView Plus device configuration - security privilege required (E, or A). Press to set the controller clock time to the PanelView clock time - security privilege required (E, or A).

Follow these steps to access the Hardware screen.

1. Press to close any open pop-up screens and return to a main screen showing the navigation toolbar.
2. Press on the navigation toolbar.

   The Maintenance screen appears.
3. Press to page forward, or to page backward, as required to navigate to page one of the Maintenance screen, page 1, Configuration and Settings (shown here).

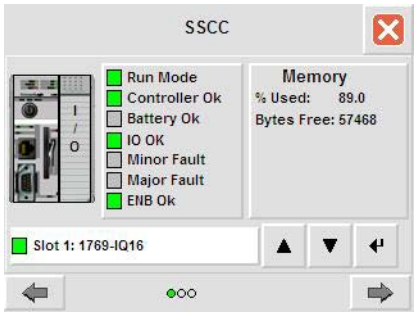


4. Press to open the Hardware screen - Controller Status (page 1).

Controller Status

The Controller Status page provides details on the controller and a selector to access individual I/O module details.

Figure 50 - Hardware Screen, Page 1 - Controller Status



A variety of status information is presented adjacent to the controller graphic image on the Controller Status page. These indications are detailed in the following tables.

Table 91 - Application Mode Status

Indication	Description
Run Mode	The application is in Run mode. This is the normal operating mode for the system.
Program Mode	The application is in Program mode. Use the key on the front of the controller to switch to Run mode.
Test Mode	The application is in Test mode. Use the key on the front of the controller to switch to Run mode.

Table 92 - Controller Status

Indication	Description
Controller Ok	The controller is healthy. This is the normal operating mode for the system.
Controller Fault	The controller status is faulted. A critical fault has occurred on the controller and it is not in operation. Search for additional details under the major faults.

Table 93 - Battery Status

Indication	Description
Battery Ok	The controller battery is OK. This is the normal indication for the system.
Battery Fault	The controller batter is low and should be replaced.

Table 94 - I/O System Status

Indication	Description
IO OK	All the I/O modules are running. This is the normal indication for the system
IO Not OK (flashing green)	At least one I/O module is not running. Check individual module status on the I/O Module Selector to identify a particular module. Search additional details for individual I/O modules.
I/O Not Respond (flashing red)	None of the I/O modules are running. Check the levers on the top of each Compact I/O module and I/O end cap. They should all be properly positioned to left, to engage the connection to each other and the controller. Restart the system. If the problem persists contact Rockwell Automation for assistance.
I/O Not Present	There are no I/O modules configured in the system. This indication is not expected to appear, as the system is pre-configured for I/O connections. Contact Rockwell Automation for assistance.

Table 95 - Minor Fault Status

Indication	Description
Minor Fault	There are no minor faults reported for the controller. This is the normal indication for the system.
Minor Fault	There is at least one minor fault reported for the controller. Navigate to Hardware Status page 2 for further details on minor faults. Minor faults are recoverable, and can be reset on page 2. If the fault persists contact Rockwell Automation for assistance.

Table 96 - Major Fault Status

Indication	Description
Major Fault	There are no major faults reported for the controller. This is the normal indication for the system.
Major Fault	There has been a major fault reported for the controller, and the controller has been stopped. Some major faults are recoverable. You can restart the system and observe if the fault is cleared or persists. If the fault persists contact Rockwell Automation for assistance.

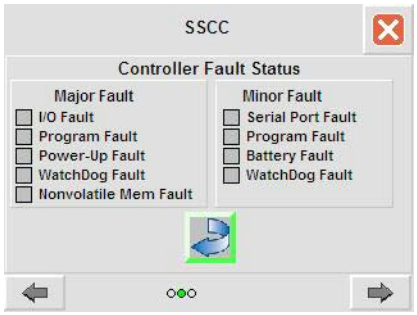
Table 97 - Ethernet Status

Indication	Description
ENB Ok	The onboard Ethernet interface is operating normally. This is the normal indication for the system.
ENB Not OK	A fault is reported for the onboard Ethernet interface. Restart the system. If the problem persists contact Rockwell Automation for assistance.

Controller Major and Minor Fault Status

Additional details about major and minor fault status for the controller is available on page 2 of the Hardware Status screen.

Figure 51 - Hardware Screen, Page 2 - Major and Minor Faults



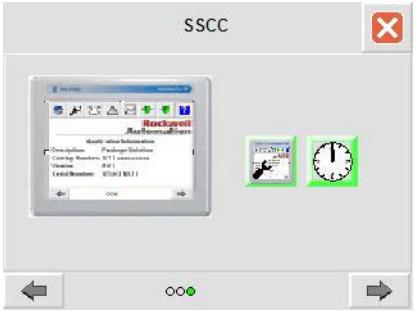
The reset button on this screen can be used to reset controller faults. This will normally pertain to minor faults. In case of major faults, it is often necessary to restart the controller.

The Reset button requires security privileges (operator, supervisor, maintenance, engineer, or administrator).

PanelView Maintenance

The PanelView Plus Maintenance page is shown in Figure 52.

Figure 52 - Hardware Screen, Page 3 - PanelView Plus Maintenance



This page contains the following icons.

Icon	Action
	Exits the HMI graphics, and accesses the PanelView Plus configuration and maintenance features (network settings, file management, screen saver, and PanelView date/time). Consult the PanelView Plus product documentation for details.
	Sets the clock in the controller using the present clock settings on the PanelView.

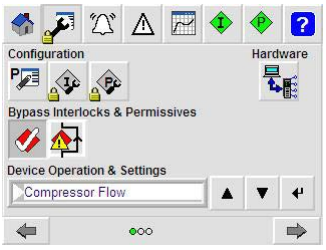
I/O Modules

I/O Module Detail screens facilitate installation and commissioning activities, and system troubleshooting. Follow these steps to access the desired I/O Module Detail screen.

1. Press to close any open pop-up screens and return to a main screen showing the navigation toolbar.
2. Press on the navigation toolbar.

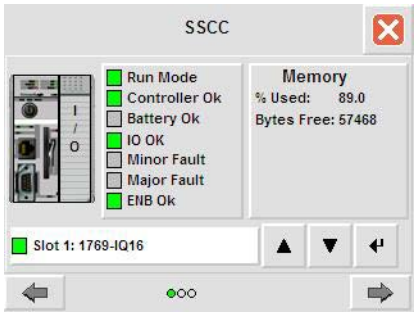
   The Maintenance screen appears.

3. Press → to page forward, or ← to page backward, as required to navigate to page one of the Maintenance screen, page 1, Configuration and Settings (shown here).



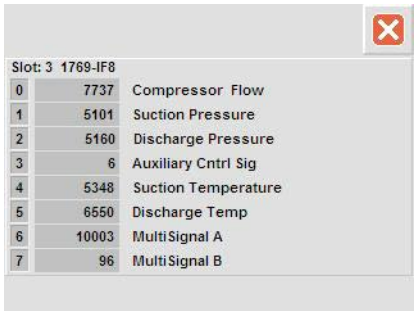
4. Press to open the Hardware screen - Controller Status (page 1).

5. Press → to page forward, or ← to page backward, as required to navigate to page one of the Hardware screen, page-1 – Controller Status (shown here).



6. Press ▲ ▼ to select the desired module from the I/O Module selector list at the bottom of the screen. The following I/O modules are available.
   - For Digital Inputs: Slot 1: 1769-IQ16
   - For Digital Outputs: Slot 2: 1769-OB16
   - For Analog Inputs: Slot 3: 1769-IF8
   - For Analog Outputs: Slot 4: 1769-OF4

7. Press ↵ to open the IO Module Detail page (for example: Analog Inputs).


Slot: 3 1769-IF8
0 7737 Compressor Flow
1 5101 Suction Pressure
2 5160 Discharge Pressure
3 6 Auxiliary Cntrl Sig
4 5348 Suction Temperature
5 6550 Discharge Temp
6 10003 MultiSignal A
7 96 MultiSignal B

Digital Input Module Detail

The Digital Input Module Detail screen is shown in Figure 53.

Figure 53 - Digital Input Module Detail

Slot: 1 1769-IQ16
0 Compressor Run DI
1 Reset PB
2 Load Request PB
3 Unload Request PB
4 Not Used
5 Not Used
6 Not Used
7 Not Used
8 Extnl Rdy To Start 1
9 Extnl Rdy To Start 2
10 Extnl Rdy To Start 3
11 Extnl Rdy To Start 4
12 Extnl Comp Trip 1
13 Extnl Comp Trip 2
14 Extnl Comp Trip 3
15 Extnl Comp Trip 4

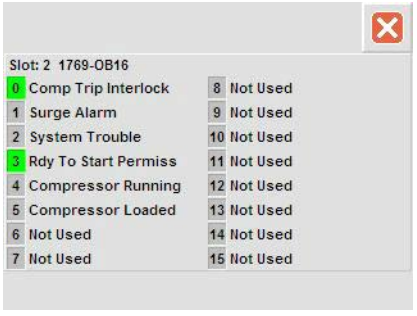
For each input channel, the channel number and description are presented. The channel descriptions on this screen are fixed and cannot be customized. They reflect the allocated function for each channel. The channel number is used as a status indicator for the individual channel.

Visual Indication Example	Explanation
0 Compressor Run DI	The green color indicates the input is energized, logic 1.
0 Compressor Run DI	The grey color indicates the input is de-energized, logic 0.
0 Compressor Run DI	The red color indicates a fault is reported.

Digital Output Module Detail

The Digital Output Module Detail screen is shown in Figure 54.

Figure 54 - Digital Output Module Detail



For each output channel, the channel number and description are presented. The channel descriptions on this screen are fixed and cannot be customized. They

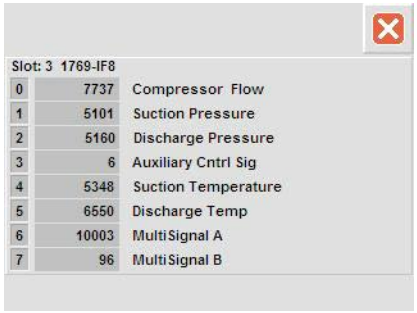
reflect the allocated function for each channel. The channel number is used as a status indicator for the individual channel.

Visual Indication Example	Explanation
0 Comp Trip Interlock	The green color indicates the output command is logic 1, to energize the connected device.
0 Comp Trip Interlock	The grey color indicates the output command is logic 0, to de-energize the connected device.
0 Comp Trip Interlock	The red color indicates a fault is reported.

Analog Input Module Detail

The Analog Input Module Detail screen is shown in Figure 55.

Figure 55 - Analog Input Module Detail


Slot: 3 1769-IF8
0 7737 Compressor Flow
1 5101 Suction Pressure
2 5160 Discharge Pressure
3 6 Auxiliary Cntrl Sig
4 5348 Suction Temperature
5 6550 Discharge Temp
6 10003 MultiSignal A
7 96 MultiSignal B

For each input channel, the channel number, input raw count, and description are presented. The channel descriptions on this screen are fixed and cannot be customized. They reflect the allocated function for each channel. The channel number and value are used as a status indicator for the individual channel.

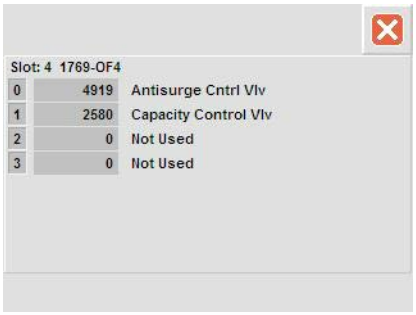
Visual Indication Example	Explanation
1 5095 Suction Pressure	The grey color indicates the input is normal.
1 5061 Suction Pressure	The red color indicates a fault is reported.

The analog input channels are configured for input range of 4...20 mA, with data format percent range. This configuration reports a raw count of 0 at 4 mA, to 10000 at 20 mA. The percent range configuration makes reading the input as a percent of transmitter span quite simple. For example, a reading of 2500 is 25.00% of the transmitter span, or 8.0 mA. The absolute measurement/reported range is -500 (3.2 mA) to 10625 (21.0 mA).

Analog Output Module Detail

The Analog Output Module Detail screen is shown in Figure 56.

Figure 56 - Analog Output Module Detail



For each output channel, the channel number, output command value, and description are presented. The channel descriptions on this screen are fixed and cannot be customized. They reflect the allocated function for each channel. The channel number and value are used as a status indicator for the individual channel.

Visual Indication Example	Explanation
0 4919 Antisurge Cntrl Vlv	The grey color indicates the output is normal.
0 6005 Antisurge Cntrl Vlv	The red color indicates a fault is reported.

The analog output channels are configured for output range of 4...20 mA, with data format percent range. This configuration generates the 4...20 mA output from a command range of 0 to 10000 counts. The percent range configuration makes reading the output command as a percentage, e.g. a command of 7500 is 75.00% to the control device, or 16.0 mA.

Alarms

The overall unit Alarm status is presented on the Alarms button (third from the left) displayed on the Navigation Toolbar of any main screen.

The alarm status is represented by the bell color and its steady or flashing status as explained in Table 98 on page 173.

Table 98 - Unit Alarm Summary Icon Indications

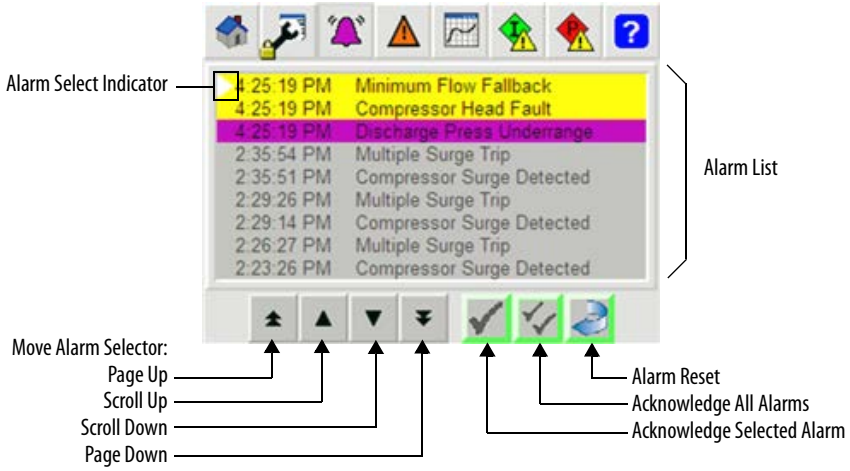
Alarm Icon	Alarm Severity	Bell Color - Status	Explanation
	4: Fault Hardware faults, Xmtr faults	Pink - steady	Active alarm present, check Alarm screen for details
		Pink - flashing	Alarm cleared, reset alarm on Alarm screen
	3: Exception Compressor Trip conditions	Red - steady	Active alarm present, check Alarm screen for details
		Red - flashing	Alarm cleared, reset alarm on Alarm screen
	2: Alert Hi / Lo Alarms, Control Fallback Strategies	Yellow - steady	Active alarm present, check Alarm screen for details
		Yellow - flashing	Alarm cleared, reset alarm on Alarm screen
	1: Information Surge Testing	Blue - steady	Active alarm present, check Alarm screen for details
		Blue - flashing	Alarm cleared, reset alarm on Alarm screen
	None	White - solid	No active alarms, no alarms require reset

To check the status of the Alarms, press the Alarms button on the toolbar to open the Alarms screen.

Managing Alarms

The SSCC alarms are managed from a single Alarm screen. The features of the Alarm screen are shown in the following figure.

Figure 57 - Alarm Screen Components



Within the alarm list, the individual alarm message status is graphically represented based on the alarm state (active or inactive) and acknowledgement (Ack'd or not-Ack'd).

Alarm State	Acknowledgement	Alarm Message Representation
Active	Not Acknowledged	Severity Color – Flashing
Active	Acknowledged	Severity Color – Steady
Inactive	Not Acknowledged	Dark Grey – Flashing
Inactive	Acknowledged	Light Grey – Steady (historical)

All the alarms defined in the SSCC are listed in the next table. The table is sorted alphabetically by alarm message.

Table 99 - Alarm Messages

Alarm Message	Severity	Explanation of Condition
Analog Input Module Failure	Fault (4)	Fault reported for analog input module in Slot 3
Analog Output Module Failure	Fault (4)	Fault reported for analog output module in Slot 4
AntiSurge Valve Position Error	Alert (2)	Deviation between control signal and position feedback > deviation limit and duration.
Aux Control Signal Overrange	Fault (4)	Transmitter signal > 20.4 mA (Analog input raw count > 10250)
Aux Control Signal Underrange	Fault (4)	Transmitter signal < 3.6 mA (Analog input raw count < -250)
Auxiliary Control Signal High	Alert (2)	Auxiliary control signal > high alarm limit
Auxiliary Control Signal Low	Alert (2)	Auxiliary control signal < low alarm limit
Capacity Valve Position Error	Alert (2)	Deviation between control signal and position feedback > deviation limit and duration
Comm Interface Failure	Fault (4)	Fault reported for the Ethernet communication interface
Compressor Flow High	Alert (2)	Compressor flow > high alarm limit
Compressor Flow Low	Alert (2)	Compressor flow < low alarm limit
Compressor Flow Overrange	Fault (4)	Transmitter signal > 20.4 mA (Analog input raw count > 10250)
Compressor Flow Underrange	Fault (4)	Transmitter signal < 3.6 mA (Analog input raw count < -250)
Compressor Head Fault	Alert (2)	Conditions exist (i.e. transmitter faults) that prevent calculation of compressor head. As a result: Head values are set to default values (HpSim = 0.0, Pratio = 1.0, Prise = 0.0). This condition will trigger the minimum flow fallback.
Compressor Surge Detected	Alert (2)	Compressor surge detected by either: Positional surge: Operating point (OP) is below the surge limit line (SLL) value by more than the positional surge margin. Rate-of-change: The operating point decreased at a rate exceeding the configured rate-of-change limits. As a result, the offset and/or percent margin in use are automatically increased.
Controller Failure	Fault (4)	Fault reported for the controller
Digital Input Module Failure	Fault (4)	Fault reported for digital input module in Slot 1

Table 99 - Alarm Messages (Continued)

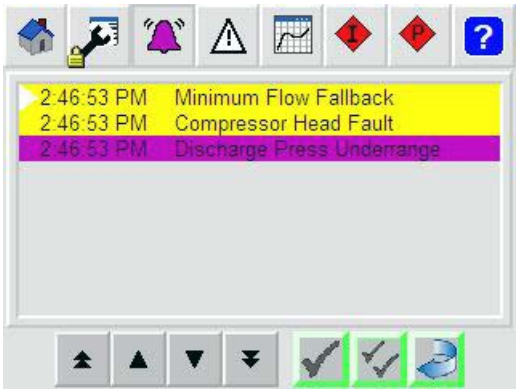
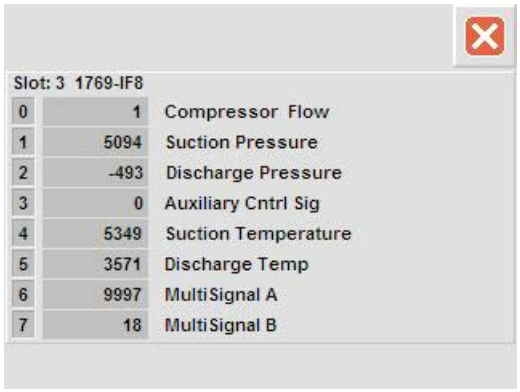
Alarm Message	Severity	Explanation of Condition
Digital Output Module Failure	Fault (4)	Fault reported for digital output module in Slot 2
Discharge Press Overrange	Fault (4)	Transmitter signal > 20.4 mA (Analog input raw count > 10250)
Discharge Press Underrange	Fault (4)	Transmitter signal < 3.6 mA (Analog input raw count < -250)
Discharge Pressure High	Alert (2)	Discharge pressure > high alarm limit
Discharge Pressure Low	Alert (2)	Discharge pressure < low alarm limit
Discharge Temp Overrange	Fault (4)	Transmitter signal > 20.4 mA (Analog input raw count > 10250)
Discharge Temp Underrange	Fault (4)	Transmitter signal < 3.6 mA (Analog input raw count < -250)
Discharge Temperature High	Alert (2)	Discharge temperature > high alarm limit
Discharge Temperature Low	Alert (2)	Discharge temperature < low alarm limit
External Trip 1	Exception (3)	The external compressor trip signal connected to DIN channel 12 is in the “Tripped” condition. As a result, a compressor trip is generated.
External Trip 2	Exception (3)	The external compressor trip signal connected to DIN channel 13 is in the “Tripped” condition. As a result, a compressor trip is generated.
External Trip 3	Exception (3)	The external compressor trip signal connected to DIN channel 14 is in the “Tripped” condition. As a result, a compressor trip is generated.
External Trip 4	Exception (3)	The external compressor trip signal connected to DIN channel 15 is in the “Tripped” condition. As a result, a compressor trip is generated.
Incipient Surge	Alert (2)	Incipient surge signal > high alarm limit
Minimum Flow Fallback	Alert (2)	Triggered by Compressor Head Fault. Without a calculated head, the surge limit line (SLL) value cannot be determined by normal lookup table. In this condition, the SLL value is set to the largest OP value defined for the surge map, to assure a minimum safe flow through the compressor.
Minimum IGV Fallback	Alert (2)	Triggered by an inlet guide vane (IGV) position signal failure. As a result, IGV methods for the surge limit line fallback to using the most conservative IGV position - full open.
Multi-Use Signal A Overrange	Fault (4)	Transmitter signal > 20.4 mA (Analog input raw count > 10250)
Multi-Use Signal A Underrange	Fault (4)	Transmitter signal < 3.6 mA (Analog input raw count < -250)
Multi-Use Signal B Overrange	Fault (4)	Transmitter signal > 20.4 mA (Analog input raw count > 10250)
Multi-Use Signal B Underrange	Fault (4)	Transmitter signal < 3.6 mA (Analog input raw count < -250)

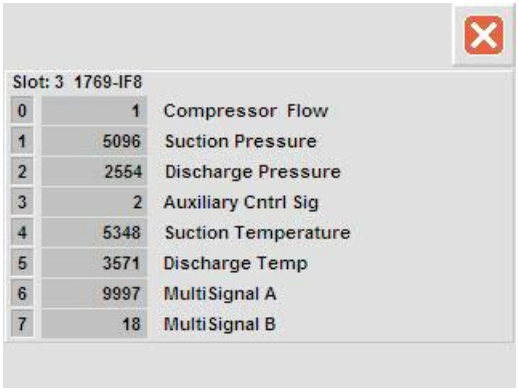
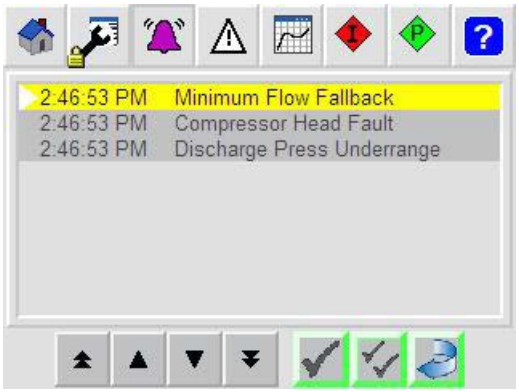
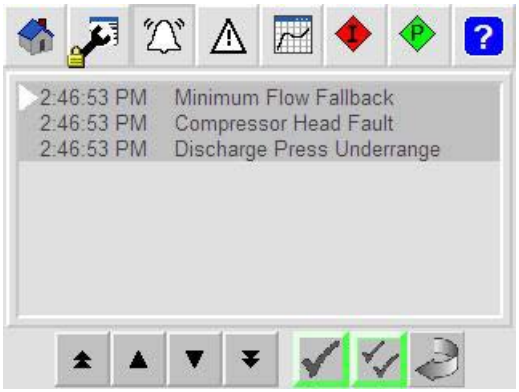
Table 99 - Alarm Messages (Continued)

Alarm Message	Severity	Explanation of Condition
Multiple Surge Trip	Exception (3)	Multiple surges have occurred within a configured time period. As a result, a compressor trip is generated.
Operating Point (OP) Fault	Exception (3)	Conditions exist (i.e. transmitter fault or configuration errors) that prevent calculation of the operating point. As a result, a compressor trip is generated.
Suction Press Overrange	Fault (4)	Transmitter signal > 20.4 mA (Analog input raw count > 10250)
Suction Press Underrange	Fault (4)	Transmitter signal < 3.6 mA (Analog input raw count < -250)
Suction Pressure High	Alert (2)	Suction pressure > high alarm limit
Suction Pressure Low	Alert (2)	Suction pressure < low alarm limit
Suction Temp Overrange	Fault (4)	Transmitter signal > 20.4 mA (Analog input raw count > 10250)
Suction Temp Underrange	Fault (4)	Transmitter signal < 3.6 mA (Analog input raw count < -250)
Suction Temperature High	Alert (2)	Suction temperature > high alarm limit
Suction Temperature Low	Alert (2)	Suction temperature < low alarm limit
Surge Test Enabled	Information (1)	Surge test is enabled, which bypasses the Manual mode protection for the anti-surge primary PID loop.

Alarm Example

The following sequence provides an example of checking and resetting alarms.

Alarm status Indications	Observations and Actions
	The color of the Alarm button indicates the alarm condition: • Color is pink - steady: alarm severity is Fault (4). • Press to open the Alarm screen.
	On the Alarm screen, there are three alarms shown. Each alarm has a flashing color indication. The alarm with the alarm severity, fault (pink) is represented by the "Discharge Press Underrange" alarm. In this case, a bad discharge pressure signal causes the "Compressor Head Fault," which triggers the "Minimum Flow Fallback" control strategy. Press to acknowledge all of the alarm indications. All three alarms become steady color after acknowledgement.
	Investigation of the discharge pressure analog input signal confirms that the transmitter signal is below the threshold for underrange. This example shows the Analog Input Module Detail screen and AI channel 2 percent range value is less than the underrange threshold of "-250." Maintenance is tasked with field troubleshooting and repairing of the transmitter signal.

Alarm status Indications	Observations and Actions
	Maintenance determines the field transmitter is bad and replaces it. The analog input signal is back in normal range.
	Returning to the Alarm screen, two of the alarms have cleared: • The underrange cleared with the successful transmitter replacement. With the discharge pressure signal healthy, the compressor head calculation fault has also cleared. • The "Minimum Flow Fallback" is still presented as an active alarm, as the system is still using this fallback strategy. The Alarm button is flashing pink, indicating the alarm severity (Fault-4) is cleared and can be reset.
	Press . This resets the alarm status, and also resets the "Minimum Flow Fallback" condition, returning the anti-surge control strategy to normal. All the alarm conditions are clear on the alarm list. The Alarm button color is white (no alarms).

Configuration Errors

The SSCC has built in a basic configuration error routine. When a configuration error is detected, a warning is generated. Configuration errors should be cleared before running the compressor.

Table 100 - Configuration Errors

Configuration Error	Check the following
Head Calc Config Error	One or more of the following configuration properties must be corrected: Suction Pressure AIN configured for Use, Ref List-2, Param-1 Discharge Pressure AIN configured for Use, Ref: List-3, Param-1 Gas ratio of Specific Heats (1.0 < value < 2.0), Ref List-11, Param-3 Polytropic Efficiency (0.0 < value < 1.0), Ref List-11, Param-4 If Variable Polytropic exponent is configured (Ref: List-11, Param-9) then: Suction Temperature AIN configured for Use, Ref: List-5, Param-1 Discharge Temperature AIN configured for Use, Ref: List-6, Param-1
OP Calc Config Error	One or more of the following configuration properties must be corrected: Flow AIN configured for Use (value = 1, 2, 3, or 4), Ref: List-1, Param-1 Maximum Flow range normalization (Qmax > 0.0), Ref: List-11, Param-7 Base Pressure of Compressor (Pbc > 0.0), Ref: List-11, Param-2 Base Temp of Compressor (Tbc > 0.0), Ref: List-11, Param-1 Base Pressure of Flow Measurement (Pbo > 0.0), Ref List-11, Param-6 Base Temp of Flow Measurement (Tbo > 0.0), Ref List-11, Param-5
Surge Map Config Error	One or more of the following configuration properties must be corrected: Surge Map X-axis Normalized Flow values, $\%Q^2$ must be ascending: Pt-0 <= Pt-1, Pt-1 <= Pt-2,…Pt-8 <= Pt-9, Pt-9 < Pt-10 Ref: List-12, Param-1 to 11 Surge Map Y-axis Compressor Head values must be ascending: Pt-0 <= Pt-1, Pt-1 <= Pt-2,…Pt-8 <= Pt-9, Pt-9 < Pt-10 Ref: List-12, Param-12 to 22 If Inlet Guide Vane Method is configured (Ref: List-11, Param-12) then: Surge Map IGV values must be ascending: Pt-0 <= Pt-1, Pt-1 <= Pt-2,…Pt-8 <= Pt-9, Pt-9 < Pt-10 Ref: List-12, Param-23 to 33

Startup or Operating Issues

This section covers some of the issues that can be found during the compressor startup or operation process and the suggested actions for correcting the issue.

Table 101 - Compressor Startup/Operation Symptoms and Suggested Action(s)

Symptom	Suggested Action(s)
Compressor will not start	Check the interlocks used to generate the compressor trip output signal. Investigate any "Trip" conditions, they must be cleared or bypassed to start. Reset the latched Interlocks using "Interlock reset". Check the Compressor Trip Digital Output Device faceplate - should be in Program mode. Check the permissives used to generate a "Ready to Start" output signal. Investigate any "Not Ready" conditions - they must be ready or bypassed to start. Check the Ready To Start Digital Output Device faceplate - should be in Program mode.
Compressor is running, but run is not indicated on the Compressor Overview screen	Check methods for run determination: Compressor Run Digital Input: • Check the input signal on DIN channel-0. • Check the channel fuse. • Check that the digital input channel is configured for use. • Check the device faceplate if the input is in Substitute PV mode. Compressor head used for run determination: • Check for: Compressor Head > Head Run Threshold • Check for a "Compressor Head Calc" fault . Auxiliary control PV used for run determination (i.e. Amps): • Check for: Aux Control PV > Aux Run Threshold • Check if the Aux Control Device faceplate if input is in Substitute PV mode. Check the on-delay timer preset for run determination.
Compressor will not load	Check method for load request. External load push button: • Check the input signal on DIN channel-2. • Check the channel fuse. The Load button is located on the HMI Operator screen - security privilege is required.
Digital input signal is wired to controller, but functionality does not work	Check the wiring for the input on TS1. Check the fuse for the input on TS1. Check that the DI status reports correctly on the IO screen for the digital input module. Check that the DI channel is configured for use. Check that the input state for the channel is configured correctly. Open the device faceplate, check if device in Substitute PV mode.
Analog input signal is wired to controller, but functionality does not work	Check the wiring for the input on TS1. Verify that the polarity is correct. Check the fuse for the input on TS1. Check the analog input reading on the IO screen for the analog input module. Raw counts read 0 at 4 mA, and 10000 at 20 mA. Check that the AI channel is configured for use. Check that the engineering unit range and scaling is configured correctly. Open the device faceplate, check if device in Substitute PV mode.

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